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With BRITISH INDUSTRIES FAIR SUPPLEMENT.

The Engineer.

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The Engineer

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PUBLIC NOTICES

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Wednesday, 4th March, 1931, for HEATING, &c., at the Telephone Exchange, Tipton, Staffs.

Drawings, specification, and a copy of the conditions and form of contract, bills of quantities and form for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works). The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 6514

The Director-General, India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for:—
10,000 INDIA RUBBER SPRINGS and 45,000 INDIA RUBBER CUSHIONS for WINDOW RESTS.
Tenders due 27th February, 1931.
Forms of Tender available from the above at a fee of 5s., which will not be returned. 6522

Crown Agents for the COLONIES.
COLONIAL GOVERNMENT APPOINTMENTS.
APPLICATIONS from qualified candidates are INVITED for the following POST:—
M/2520.—SENIOR BRIDGE CONSTRUCTION ENGINEER REQUIRED by the GOVERNMENT of NORTHERN RHODESIA for a tour of 20 to 30 months' service and possible extension. Salary £720 a year, rising to £840 a year by annual increments of £30. Free quarters and passages and liberal leave on full salary. Candidates, 30 to 40 years of age, preferably single, must be Corporate Members of the Institution of Civil Engineers, or hold professional qualifications accepted by that Institution. Must have had good experience in the Erection of Large Steel and Concrete Bridges.
Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience and mentioning this paper, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/2520. 6356

Administrative County of LONDON.
LOTS-ROAD PUMPING STATION.
INCREASED PUMPING POWER, 1931.
The London County Council invites TENDERS for the SUPPLY and ERECTION at Lots-road Pumping Station, Lots-road, Chelsea, S.W. 10, of FIVE STORM WATER PUMPING SETS, each consisting of a 600 B.H.P. Gas or Heavy Oil Engine coupled to a Vertical-spindle Pump through bevel gearing.
The specification, form of Tender, &c., may be obtained on and after Monday, the 16th February, 1931, on application to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1, upon payment of £5 by cheque, draft or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application and the contract documents may be inspected before payment of the fee.
Remittances by post should be addressed to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 2, No. 3, Warwick House-street, Cockspur street, S.W. 1.
The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."
No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 23rd March, 1931, will be considered.
The Council does not bind itself to accept the lowest or any Tender.
MONTAGU H. COX.
6511 Clerk of the London County Council.

Administrative County of LONDON.
DEPTFORD PUMPING STATION.
INCREASED PUMPING POWER, 1930.
The London County Council invites TENDERS for the EXECUTION of WORKS in connection with the INSTALLATION of NEW PUMPING MACHINERY at Deptford Pumping Station, Greenwich-road, London, S.E. 10.
The works include New Internal Walls and Foundations for Pumping Machinery inside the Engine-house; also Short Lengths of Brick and Cast Iron Sewers, the Lining of an existing Sewer with Reinforced Concrete and Alterations to existing Sewers.
The following approximate quantities indicate the extent of the work to be carried out:—Excavation, 4000 cubic yards; concrete, 1000 cubic yards; brickwork, 750 cubic yards; structural steel work, 60 tons; cast iron pipes, 125 tons.
It will be a condition of the contract that the work must be actively commenced by 1st April, 1931, and the contractor must comply, as regards the employment of labour, with the terms and conditions laid down by the Unemployment Grants Committee.
The specification, form of Tender, drawings, &c., may be obtained on application to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1, upon payment of £10 by cheque, draft or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application and the contract documents may be inspected before payment of the fee.
Remittances by post should be addressed to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 2, No. 3, Warwick House-street, Cockspur-street, S.W. 1.
The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."
No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 9th March, 1931, will be considered.
The Council does not bind itself to accept the lowest or any Tender.
MONTAGU H. COX.
6515 Clerk of the London County Council.

PUBLIC NOTICES

Administrative County of LONDON.
The London County Council invites TENDERS for the SUPPLY, DELIVERY and ERECTION of ONE NEW WASHING MACHINE at Kensington Institution, Marloes-road, Kensington, W. 8.
The specification, form of Tender, &c., may be obtained on application to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1, on and after 11th February, 1931, upon payment of £1 by cheque, draft or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application and the contract documents may be inspected before payment of the fee.
Remittances by post should be addressed to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 2, No. 3, Warwick House-street, Cockspur-street, S.W. 1.
The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."
No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Wednesday, 25th February, 1931, will be considered.
The Council does not bind itself to accept the lowest or any Tender.
MONTAGU H. COX.
6505 Clerk of the London County Council.

Swanage Pier Company.
REPAIR WORKS.
The Swanage Pier Company have FOR DISPOSAL a QUANTITY of PLANT, TOOLS, &c., including an Ingersoll-Rand Type Twenty Petrol-driven Air Compressor, Air-driven Circular Saw and Boring Machines, a Petrol-driven Circular Saw Bench and Divers' Equipment. The plant and tools are to be sold by Tender, and may be inspected at Swanage at any time up to the 28th instant. Schedules and Tender forms may be obtained by application to the undersigned on payment of Five Shillings.
M. DU-PLAT-TAYLOR, M. Inst. C.E.,
Consulting Engineer to the Company.
36, Victoria-street, S.W. 1. 6502

PUBLIC NOTICES

Northampton Polytechnic INSTITUTE,
ST. JOHN-STREET, E.C. 1.
A COURSE OF FOUR LECTURES
on
DIELECTRICS:
A REVIEW OF RECENT RESEARCH ON PROBLEMS OF INSULATION,
By L. HARTSHORN, Esq., D.Sc., A.R.C.S., D.I.C. (National Physical Laboratory),
On WEDNESDAYS, at 8 p.m.,
Commencing March 4th, 1931.
The lectures will deal with the phenomena of leakage, absorption, power losses in alternating fields, dielectric strength, &c., and will be particularly addressed to those concerned with the manufacture and industrial applications of insulating materials.
FEE FOR THE COURSE, 5s.
S. C. LAWS, M.A., M.Sc.,
6507 Principal.

University of Birmingham.
FACULTY OF SCIENCE.
PROFESSORSHIP OF MECHANICAL ENGINEERING.
The Council of the University invites APPLICATIONS for the CHAIR of MECHANICAL ENGINEERING, vacant by the retirement of Professor F. W. Burstall.
The stipend offered is £1200 a year.
Twenty-four copies of applications, which may be accompanied by copies of not less than three testimonials, references, or other credentials, should be forwarded to the Registrar, The University, Edgbaston, Birmingham, to reach him not later than 9th March, 1931.
It is desirable that the selected candidate should enter upon his duties on the 1st of October next.
Further particulars may be obtained from
C. G. BURTON,
6490 Secretary.

PUBLIC NOTICES

Armstrong College,
NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)
COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.Sc. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.
The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.
Full particulars of the Courses may be had on application to
THE REGISTRAR,
Armstrong College,
6289 Newcastle-upon-Tyne.

Middlesex Education Committee.
ACTON JUNIOR TECHNICAL SCHOOL,
HIGH-STREET, ACTON, W. 3.
REQUIRED, an ASSISTANT MASTER, to commence duty at the beginning of the summer term, 1931. Graduate in Electrical Engineering and preferably a Corporate Member of the Institution of Electrical Engineers. Salary, Burnham Scale (London area). Appointment will be subject to satisfactory medical examination.
Form of application and further particulars may be obtained by sending a stamped addressed foolscap envelope to Dr. J. E. Smart, Education Offices, Acton, W. 3, to whom applications should be returned not later than 28th February, 1931.
H. M. WALTON,
6523 Secretary.

Metropolitan Water Board.
TENDERS FOR THE SUPPLY OF CAST IRON PIPES.
The Metropolitan Water Board invite TENDERS for the SUPPLY of CAST IRON STRAIGHT PIPES and SPECIALS for the periods of six and twelve months, commencing 1st April, 1931.
Tenders must be submitted on the official forms (Tender No. 31), which may be obtained on and after Monday, 9th February, 1931, from the Chief Engineer, by personal application at the offices of the Board (Room 156) or upon forwarding a stamped addressed sack envelope.
Tenders, enclosed in sealed envelopes, addressed to the Clerk of the Board and endorsed "Tender for Cast Iron Pipes," must be delivered at the offices of the Board (Room 122) not later than 11 a.m. on Monday, 2nd March, 1931.
The Board do not bind themselves to accept the lowest or any Tender.
G. F. STRINGER,
Clerk of the Board.
Offices of the Board,
173, Rosebery-avenue, E.C. 1.
30th January, 1931. 6463

Metropolitan Water Board.
TENDERS FOR THE SUPPLY OF PHOTO PRINTS, &c.
The Metropolitan Water Board invite TENDERS for the SUPPLY of PHOTO PRINTS, &c., for the periods of six and twelve months, commencing 1st April, 1931.
Tenders must be submitted on the official forms (Tender No. 27), which may be obtained on and after Monday, 9th February, 1931, from the Chief Engineer, 173, Rosebery-avenue, E.C. 1, by personal application at the offices of the Board (Room 156) or upon forwarding a stamped addressed sack envelope. Samples of the paper required can be seen at the offices of the Board (Room 201).
Tenders, enclosed in sealed envelopes addressed to the Clerk of the Board and endorsed "Tender for Photo Prints, &c.," must be delivered at the offices of the Board (Room 122) not later than 11 a.m. on Monday, 2nd March, 1931.
The Board do not bind themselves to accept the lowest or any Tender.
G. F. STRINGER,
Clerk of the Board.
Offices of the Board,
173, Rosebery-avenue, E.C. 1.
30th January, 1931. 6464

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PUBLIC NOTICES

ROYAL SHOW

WARWICK

July 7th to 11th, 1931.

EXHIBITION OF IMPLEMENTS, &c.

The Regulations and Forms of Application for Space are now ready.

Applications for space must be made by

Friday, March 20th, 1931.

ENTRIES for Silver Medal close March 2nd.

Live Stock, Produce and Forestry entries close on MAY 20th; Flower Show on MAY 27th; Poultry and Butter Making Competitions on MAY 30th; Cider, Plantations, Home Nurseries, Orchards and Fruit Plantations on MAY 1st.

T. B. TURNER, Secretary.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND,
16, Bedford Square, London, W.C. 1. 6500

Borough of Twickenham.

MAIN OUTFALL SEWER.

The Corporation are prepared to receive TENDERS from experienced contractors for the CONSTRUCTION of ABOUT 2541ft. of 48in. diameter BRICK and CONCRETE SEWER in Tunnel, with EIGHT MAN-HOLES and a SCREENING CHAMBER, and other WORKS in the Borough of Twickenham.

Drawings and specification of the proposed works may be inspected at the office of Mr. Gilbert R. King, Borough Engineer and Surveyor, Municipal Offices, Twickenham, and also at the office of the Consulting Engineers, Messrs. William Fairley and Co., Parliament Mansions, Victoria-street, Westminster, S.W. 1.

A copy of the bill of quantities and form of Tender may be obtained on deposit of a crossed cheque for Five Guineas, made payable to the Corporation, which deposit will be returned on receipt by the Corporation of a bona fide Tender.

Sealed Tenders, on the forms provided, are to be delivered to the undersigned not later than Noon on Wednesday, 4th March, 1931.

The Corporation do not bind themselves to accept the lowest or any Tender.

EDWIN G. STRAY,
Town Clerk.

Municipal Offices,
Twickenham,
10th February, 1931. 6534

County Council of the County

OF ROXBURGH.

CONSTRUCTION OF BRANXHOLME BRIDGE IN REINFORCED CONCRETE.

The Council are prepared to receive TENDERS for the CONSTRUCTION of the above BRIDGE near Hawick, on the Edinburgh-Carlisle Road.

Drawings and specification, &c., may be seen on and after Tuesday, 17th February, 1931, at the office of Messrs. Blyth and Blyth, MM. Inst. C.E., Consulting Engineers, 135, George-street, Edinburgh.

Specification, bill of quantities, form of Tender and all information required may be obtained on and after the same date at the above office on depositing £3 3s., which deposit will only be returned on the receipt of a bona fide Tender and the return of all the documents. Cheques should be made payable to the County Council of the County of Roxburgh.

An engineer will meet contractors at Branxholme Bridge at twelve noon on Tuesday, the 24th February, 1931, to show them the site.

Sealed Tenders, endorsed "Tender, Branxholme Bridge Contract," must be lodged with the undersigned not later than Tuesday, the 10th March, 1931.

The Council do not bind themselves to accept the lowest or any Tender.

GEORGE J. SHERRIFF,
County Clerk.

County Offices,
Newtown St. Boswells,
11th February, 1931. 6510

Eastleigh and Bishopstoke

URBAN DISTRICT COUNCIL.

EASTLEIGH AND BISHOPSTOKE SEWERAGE AND SEWAGE DISPOSAL WORKS.

CONTRACT NO. 1.

SUPPLY OF CAST IRON PIPES AND SPECIALS.

The above Council invite TENDERS for the SUPPLY and DELIVERY at Eastleigh of about 6000 LIN. YARDS of 30in., 27in., 24in., 21in., 18in., 15in., 12in., 10in., 8in., and 6in. CAST IRON PIPES and SPECIALS in accordance with the specification prepared by the Engineers, Messrs. A. P. I. Cotterell and Son, Chartered Civil Engineers, 54, Victoria-street, Westminster, S.W. 1.

Copies of the specification, the bills of quantities, and the form of Tender can be obtained from the Engineers on or after Friday, 13th February, 1931, by intending contractors on payment of the sum of Five Guineas, which will be returned on receipt of a bona fide Tender and all other documents supplied.

Tenders, on the form provided, enclosed in sealed envelopes, must be delivered to the undersigned and endorsed "Cast Iron Pipes—Contract No. 1," not later than 10 a.m. on Friday, 27th February, 1931.

The Council do not undertake to accept the lowest or any Tender, but reserve freedom of action.

By Order,
J. LAWRENCE,
Clerk to the Council.

Town Hall, Eastleigh, Hants. 6511

Manchester Corporation.

The Town Planning Committee invite TENDERS for the CONSTRUCTION of the IRK VALLEY-ROAD (from School-lane, Blackley, to the City Boundary, Middleton), and the CONSTRUCTION of the MIDDLETON CONNECTING SEWER (from Middleton Old-road, Blackley, to the connection with the Middleton Sewage Works).

Plans may be seen and specifications, bills of quantities and forms of Tender obtained on application at the City Engineer's Office, Town Hall, Manchester, on payment to the City Treasurer of £5 5s., which sum will, after the Corporation have come to a decision upon the Tenders received, but not before, be returned to the persons submitting bona fide Tenders.

All cheques or postal orders are to be made payable to the order of "The Corporation of Manchester."

Tenders, enclosed in the official envelope and addressed to the Chairman of the Town Planning Committee, are to be delivered at the City Engineer's Office not later than 9.30 a.m. on Tuesday, the 10th March, 1931.

The Corporation do not bind themselves to accept the lowest or any Tender.

F. E. WARDBECK ROWELL,
Town Clerk.

Town Hall, Manchester,
7th February, 1931. 6509

PUBLIC NOTICES

The Bengal and North Western

RAILWAY COMPANY, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

(A) 150 TONS DOGSPIKES,
(B) 2064 STEEL TYRES (LOCO., CARR. and WAGON)

as per specifications to be seen at the Company's offices.

Tenders, addressed to the undersigned and envelope marked "Tender for Dogspikes or Steel Tyres," or as the case may be, with name of firm tendering, to be lodged not later than Noon on the 3rd day of March, 1931.

(A) For each specification a fee of 10s.,
(B) for each specification a fee of £1

will be charged, which cannot under any circumstances be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
W. R. IZAT,
Managing Director.

237, Gresham House,
Old Broad-street, London, E.C. 2,
12/2/1931. 6538

Urban District Council of

LOUGHTON.

PURIFICATION, &c., PLANT FOR AN OPEN-AIR SWIMMING BATH.

Subject to the approval of the Ministry of Health being obtained, the Council invite TENDERS for the above.

Details relative to the proposed bath, and the required purification, &c., of the water, will be supplied on application being made to the Council's Surveyor, Mr. Horace White, High-road, Loughton, Essex, not later than the 18th instant.

Tenders, in sealed envelopes, marked outside "Purification Plant," must be delivered at my office by Twelve Noon on Monday, the 9th March next.

The Council's form of contract must be executed by the contractor whose Tender is accepted.

The Council do not bind themselves to accept the lowest or any Tender.

J. W. FAULKNER,
Clerk to the Council.

Council Offices,
Loughton, Essex,
11th February, 1931. 6506

For Sale.

DRAGLINE EXCAVATOR MACHINES.

Owing to the approaching completion of the Lloyd Barrage Canals, various types and sizes of Steam and Diesel-driven DRAGLINE EXCAVATORS, with spares and subsidiary plant, are available now or in the near future FOR SALE. The machines are all in good working condition, and each type may be personally inspected at work.

Full details of types, specifications, working outputs, working rates, fuel consumption, &c., sale price and other information available to bona fide inquirers on application to—

THE EXECUTIVE ENGINEER,
Dragline Division,
Barrage Township,
Sukkur, Sind,
India,
or
C. S. C. HARRISON,
Chief Engineer, Lloyd Barrage and Canals Construction.

Karachi,
Dated 27th January, 1931. 6494

Eastbourne Water Works

COMPANY.

PUMPING SUPERINTENDENT.

APPLICATIONS are INVITED for the APPOINTMENT of PUMPING SUPERINTENDENT at the Friston Pumping Station, near Eastbourne.

Applicants must be competent to take charge of the Pumping Plant, consisting of Four 240 B.H.P. Paxman Heavy Fuel Oil Engines and Deep Well Pumps, with various Auxiliary Plant, and have had practical workshop experience, as the person appointed will be required to carry out all running repairs.

The salary is £350 per annum, with free occupation of a house adjoining the Pumping Station.

Applications, which must be made on a form obtainable from the undersigned, must reach me not later than the 7th March, 1931.

A. WILKINS,
General Manager.

28, Sea Side-road, Eastbourne,
9th February, 1931. 6508

Rother and Jurys Gut Catchment Board.

ENGINEER.

APPLICATIONS are INVITED for the APPOINTMENT of an ENGINEER at a salary of £450 per annum. Application must be made in writing and state age, qualifications and experience, and be endorsed "Engineer, Catchment Board," and addressed by post to Colonel John Body, D.S.O., Witterham Court, Witterham, Kent, so as to reach him not later than Thursday, the 26th February, 1931. Canvassing, directly or indirectly, will disqualify.

EDWIN P. DAWES
Temporary Clerk.

Bank Chambers, Rye, Sussex,
5th February, 1931. 6504

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED by Firm of Engineers, MERCHANTS and REPRESENTATIVE for Sale of First-class Specialities; good salary, commission and expenses and car provided to suitable applicant who would invest up to £2000 in business, which would be guaranteed.—Address, P759, The Engineer Office. P759 A

WANTED, CIVIL ENGINEERING ASSISTANT, with experience of Dock and River Works, Bridges, &c., must be neat Draughtsman and able to make finished Drawings from Sketches.—Address, stating age, giving full particulars of experience, salary required and copies of testimonials, 6524, The Engineer Office. 6524 A

A FIRM of CONCRETE ENGINEERS REQUIRE GENERAL MANAGER. Only applicants with Live Connection and thoroughly experienced in Reinforced Concrete Business will be considered. Preference given to those prepared to invest small capital. Fullest particulars.—Address, 6530, The Engineer Office. 6530 A

AGENT.—Well-established FIRM of ROAD CONTRACTORS REQUIRE capable MAN, not over 40 years of age, to TAKE ENTIRE CHARGE of CONTRACT. State experience and salary.—Address, P771, The Engineer Office. P771 A

AGENTS WANTED in North, South and Midlands, with good connection, for sale of Machinery for Smithy Equipment. Small retaining salary and good commission.—Address, 6517, The Engineer Office. 6517 A

ASSISTANT MANAGER, Age 28-35, REQUIRED for Engineering Works, salary and commission. Must be a qualified engineer, A.M.I.M.E. or equal, accustomed to interviewing customers and preparing estimates. A knowledge of Paper Mill Plant and Factory Equipment is desirable.

Applicants should state fully education, training, and experience.—Address, 6518, The Engineer Office. 6518 A

CALCULATOR REQUIRED for Design Dept., ALBION MOTOR CAR CO., Ltd., Glasgow. Able to undertake all Stress, Deflection and other Calculations relating to Design of Commercial Vehicle and Bus Chassis, including Engines, Gear-boxes, axles, &c.

Must have first-class mathematical knowledge and some experience in this class of work.

Apply by letter, stating salary. P786 A

SITUATIONS OPEN (continued)

ENGINEERS REQUIRE IMMEDIATELY for London and district an experienced SALES REPRESENTATIVE having live connection with electricity undertakings, power users and export trade.

Only first-class applicants with proved selling records considered. State age, experience, and salary required.

Address, P784, The Engineer Office. P784 A

ENGINEER-SALESMAN.—MANUFACTURERS of Steam Speciality REQUIRE well-connected AGENTS on Commission only in Birmingham, Stafford, Nottingham, Leicester, and a few other districts. At present only salaried men are employed, and energetic work would probably lead to salaried position.

Address, 6526, The Engineer Office. 6526 A

FOUNDRY MANAGER REQUIRED, Used to Motor Trade, including Centrifugal Castings.—Address, stating age, experience, and salary required, P781, The Engineer Office. P781 A

LONDON FOUNDRY, Having Large Output of aluminium and gun-metal castings and fully equipped machine shop, REQUIRES REPRESENTATIVE with good selling connection. Replies (strictly confidential) should state full details of past experience and remuneration expected.—Address, P769, The Engineer Office. P769 A

MECHANICAL ENGINEER, with Good Technical knowledge and practical experience on heat and internal combustion engines, drawing-office experience a preference. State full particulars and salary expected.—Address, P763, The Engineer Office. P763 A

PRODUCTION DESIGN ENGINEER REQUIRED for modern large-scale Radio Production to ensure low costs. Experience in "contacting" development and manufacture. Excellent opportunity.—Write, giving age, experience, and salary required, to Box E. 137, c/o C. Mitchell and Co., 1, Snow-hill, E.C. 1. 6501 A

REPRESENTATIVE REQUIRED for the Sale of High-speed Diesel Oil Engines. Only first-class man, with sound Selling experience and proved records considered.

Reply by letter only (in confidence), giving age, details of experience and suggested terms, to: JOINT MANAGING DIRECTORS, J. and H. McLaren, Ltd., Midland Engine Works, Leeds. 6531 A

REPRESENTATIVE REQUIRED by Well-equipped Production and General Engineers. Applicant must have sound connection in the engineering trade, to be able to produce results. State full experience in confidence, together with salary expected.—Address, P773, The Engineer Office. P773 A

YOUNG ENGINEER REQUIRED to Carry Out Experimental Work on a coloured Plastic Product. Up-to-date knowledge of Dyes and Dyeing Processes essential. Starting salary £250 per annum.—Address, giving summary of training and experience, 6525, The Engineer Office. 6525 A

CHIEF DRAUGHTSMAN REQUIRED, Thoroughly experienced in the organisation of drawing-office engaged in large variety of prime movers, both oil and steam.

Address, stating age, experience, and salary required, 6423, The Engineer Office. 6423 A

DETAILING DRAUGHTSMAN REQUIRED for Constructional Steel Works in North London. Must be able to prepare shop drawings with minimum supervision and be familiar with Steel Frame (1909) Act) Buildings.—Address, stating age, experience, and salary required, P765, The Engineer Office. P765 A

DRAUGHTSMAN REQUIRED During Reconstruction of Large Power Station. Only men with good experience in the lay-out of modern plant will be considered. Wages up to £8 a week to suitable man.—Apply immediately, giving full particulars of age, training and experience, to GENERAL MANAGER, L.C.C. Tramways, 23, Belvedere-road, S.E. 1. Canvassing disqualifies. 6520 A

DRAUGHTSMEN WANTED by an Electrical Firm, familiar with Control Gear or Switchgear—Address, stating age, experience, and salary required, 6477, The Engineer Office. 6477 A

TECHNICAL DRAUGHTSMAN REQUIRED, with knowledge and experience of the Calculations and Constructions for all classes of Bones. Preference given to one with some practical experience.—Address, giving full details of age, experience, and salary required, 6487, The Engineer Office. 6487 A

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For continuation of Small Advertisements see page 4.

A Seven-Day Journal

Regulations for Public Vehicles.

A NUMBER of new regulations made by the Minister of Transport under the Road Traffic Act, 1930, came into force last Tuesday, February 10th. The most important of them apply to heavy vehicles using the roads. All new vehicles are to be fitted with pneumatic tires. A double-deck vehicle fully laden must not weigh more than 10 tons, but if more than four wheels are fitted the maximum weight may be 12 tons; single-deckers must not exceed 9 tons in weight. Among other regulations that came into force last Tuesday in connection with public passenger-carrying cars are provisions dealing with lighting, obstructions such as flap seats, width of gangways and door fastenings, whilst there is another that calls for the backs of all seats to be constructed as far as is possible to prevent the pockets of passengers being picked. Regulations with regard to vehicles in general forbid any part of a road wheel or fitting to project more than 3½in. beyond the outer face of the tire. The brakes of one of the braking systems must be applied by a pedal and no overlock shall be possible on the steering nor shall the wheels at any point foul any part of the vehicle. Among a number of other regulations with regard to steering and braking it is laid down that all connections in these systems secured by bolts or pins must have these bolts or pins fitted with nuts which must be efficiently locked. Ball and socket joints of steering connections shall not be pendant and covers which might prevent easy inspection of any joint must not be fitted. Several other regulations deal with fuel tanks and electric fittings. Further regulations apply only to vehicles registered after January 1st, 1932, and others to all vehicles on that date. A regulation which only comes into force for vehicles registered after January 1st, 1933, requires that all brakes shall act directly on the wheels and not through the transmission gear.

New Motor Speed Record.

LAST Thursday, February 5th, Captain Malcolm Campbell created a new motor speed record over the Daytona Beach course. His average speed over the measured mile was 246·154 miles per hour. As the late Major H. O. D. Segrave's speed was 231·362 miles per hour, his best record was beaten by more than 14 miles per hour. Before making his attempt Captain Campbell travelled over the course in a small car to examine the state of the surface. Though the visibility was poor and the ground somewhat uneven in spots he decided to make a trial, but in view of the advice tendered by the stewards he did not attempt to break the record by any large margin. He took a start of 5¼ miles, which is rather longer than is usual, and passed southward over the course at a speed of 246·575 miles per hour. Without pausing between the runs to change the tires or rest, he returned northward at the slightly reduced speed of 245·733 miles per hour, which gives an average speed over the course of 246·154 miles per hour. The car in which he achieved this speed is fitted with a Napier supercharged aero-engine of a type similar to that used in the machines taking part in the race for the Schneider Trophy in 1929. It develops 1400 horse-power. Many experiments were made in the wind tunnel when designing the car. Stability was attained by fitting a tail plane. The driver's position is put so low down that the differential had to be set over to the left. The gear-lever is between the legs of the driver and the gear-box in front of him. The body is made up of aluminium panels erected on a framework of steel tubes. It is reported that Captain Campbell intends to make no further efforts to advance the record at present.

A High-Pressure Löffler Boiler Installation.

THREE electricity undertakings in Czechoslovakia had decided to construct a large central power station in the Ostrau-Karwiner district, which will be jointly owned by them and will serve for generating and peak load purposes. The first part of the plant to be put down will have an output of about 42,000 kW, but the installation will later be extended to a maximum capacity of 160,000 to 200,000 kW. The power plant which is to be first installed, and for which orders have recently been placed with the Skoda Works and the Witkowitz Ironworks, will comprise three Löffler boilers, each with a designed output of 75 tons of steam per hour at a pressure of 130 atmospheres, or 1850 lb. per square inch at 500 deg. Cent. or 932 deg. Fah. These boilers are to supply steam to two turbines with an output of 21,000 kW or 30,000 kVA. The high-pressure installation is to be completed in 1932. The decision to use the Löffler high-pressure system of steam generation has been arrived at following the very successful results which have been obtained at the Vienna Locomotive Works Florisdorf plant and the power plant at the Karolinen Mine of the Witkowitz Coal Company. These two plants have been working for some years at pressures of 1560 lb. and 1700 lb. per square inch with total temperatures of 896 deg. and 932 deg. Fah. The reliability of the plants has been shown to be fully equal to those of low-pressure plants and the maintenance costs are the same. The Löffler patented method of steam raising consists, it may be recalled, of evaporating water by blowing highly superheated steam through it, the steam for this purpose being taken from the boiler itself and forced through the superheater by a steam pump.

The Vatican Wireless Station.

ON Thursday last a short-wave broadcasting and wireless telephone and telegraph duplex station, supplied by Marconi's Wireless Telegraph Company to the Vatican City, was formally inaugurated by the Pope. The station is housed in a building near the Vatican railway terminus, and in its main features the new transmitter follows the design of the Marconi short-wave, high-speed beam transmitters used in the British Imperial beam stations. The complete installation, which was made at Chelmsford, consists of four main panels, and is designed for telephony and high-speed telegraphy on wave lengths of 19·84 m. or 50·26 m. The first of the four panels is the main magnifier unit for both waves; the second contains the intermediate magnifiers, and the new Marconi-Franklin valve master drive unit for the shorter wave length; the third panel comprises the intermediate magnifier units and master drive for the longer wave length; whilst the fourth panel is a combined modulator for telephony and absorber keying unit for high-speed telegraphy. On telephony the transmitter is rated to deliver from 8 to 10 kilowatts of unmodulated carrier wave energy to the aerial feeder system, the output depending slightly on the wave length used, whilst the rating on continuous wave telegraphy is from 13 to 15 kilowatts. There are two Marconi "uniform" aerials, which are slung between self-supporting lattice steel towers, 200ft. high and spaced 296ft. apart. Every effort has been made to harmonise the transmitting buildings and aerial towers with the graceful surroundings of the Vatican City, and the tops of the aerial masts are finished off to form a bishop's mitre, which greatly enhances their appearance in silhouette. A special receiver situated in one of the rooms of the transmitting station, and utilising a vertical antenna placed at a distance of only a few yards from the sending antenna, will secure good telephone and duplex telegraph communication between the Vatican City and any part of the world.

Railwaymen's Pay.

AT the end of last week, during discussions on the points already brought before the National Wages Board with regard to the pay of railwaymen, it was suggested that the railways were overcapitalised, and Mr. Walkden, representing the Railway Clerks' Association, submitted figures showing the increases of capital of the Taff Vale Railway between 1885 and 1903, and for the Midland Railway during the same period. Mr. Cramp, for the unions, asked whether the increased earnings obtained owing to the proposed reductions in railwaymen's pay were to be used for the purpose of reducing freight charges or for paying dividends. Mr. Lazenby, for the companies, submitted figures showing that the average percentage increase in wholesale prices over those for 1913 was 207·3 in 1920 and only 19·5 in 1930. He also emphasised that the companies wished for greater elasticity in working arrangements. He said that according to the companies' proposals, a man must work the standard week of forty-eight hours before qualifying for the overtime rate of time and one-quarter, and the Sunday would be no different from any other day, unless the standard week had been exceeded. On Monday of this week Mr. Bromley opened the case for the Associated Society of Locomotive Engineers and Firemen. He put forward the claims that classification should be abolished, which meant that the 1s. a day by which the wages of drivers operating shunting engines had been reduced should be restored; that there should be a guaranteed day for Sunday duty; that the nine-hour roster of daily duty should be abolished; and that the minimum firemen's rate should be paid to engine cleaners after seven years' service.

The New P. & O. Liner Strathnaver.

ON Thursday of last week, February 5th, the first of the two new turbo-electrically propelled liners which are being constructed by Vickers-Armstrongs, Ltd., for the Australian service of the Peninsular and Oriental Steam Navigation Company, was successfully launched at Barrow-in-Furness. The new liner, which was named the "Strathnaver," has an overall length of 664ft., with a beam of 80ft. and a draught of 29ft., and her propelling mechinery has a designed output of 28,000 S.H.P., corresponding to a maximum speed of 22 knots. Provision will be made for carrying 498 first-class passengers and 668 passengers of the tourist class; while the officers and crew will number about 476 persons. The new liners will be the first P. & O. ships to be finished in white. The boiler plant comprises four Yarrow boilers, each having an evaporation of 70,000 lb. per hour and a working pressure of 400 lb. at the turbines, with a total superheat temperature of 725 deg. Fah. For auxiliary steam there will be two small water-tube boilers. When two of the main boilers are in operation the machinery will give the ship a speed of 16½ knots. The electrical propelling equipment and auxiliary generators have all been supplied by the British Thomson-Houston Company, Ltd., of Rugby, and they comprise two 3000 r.p.m., 10,700-kW, 3000-volt, three-phase alternators, along with two synchronous propulsion motors, each with a designed output of 14,000 S.H.P. at 125 r.p.m. All the controls will be grouped together, and other plant will include the balancer booster sets and the ventilating fans. The auxiliary generating plant will comprise three 750-kW turbo-generator sets and one 400-kW set. The main condensers are of the Weir regenerative type, with a designed vacuum of 28in., at a sea temperature of 82 deg. Fah.

The Modernising of Naval Vessels.

IN reply to a question which was recently put in the House of Commons as to which of the battleships and battle-cruisers in the Navy List, other than the "Rodney," "Nelson," and "Hood," had been modernised, Mr. A. V. Alexander, the First Lord of the Admiralty, stated that since 1918 nine ships of the "Queen Elizabeth" and "Royal Sovereign" classes had been brought up to date, as also had the battle-cruisers the "Renown" and the "Repulse," while the work on the "Barham" was now in hand. The main alterations, Mr. Alexander said, had consisted in the addition of bulges, the increase in some cases of the anti-aircraft armament, and improvements to the bridges and tops. The ventilation and accommodation had also been improved. In the "Renown" and the "Repulse" additional armoured protection had been given, and the total estimated cost of these items of modernisation was approximately £2,870,000.

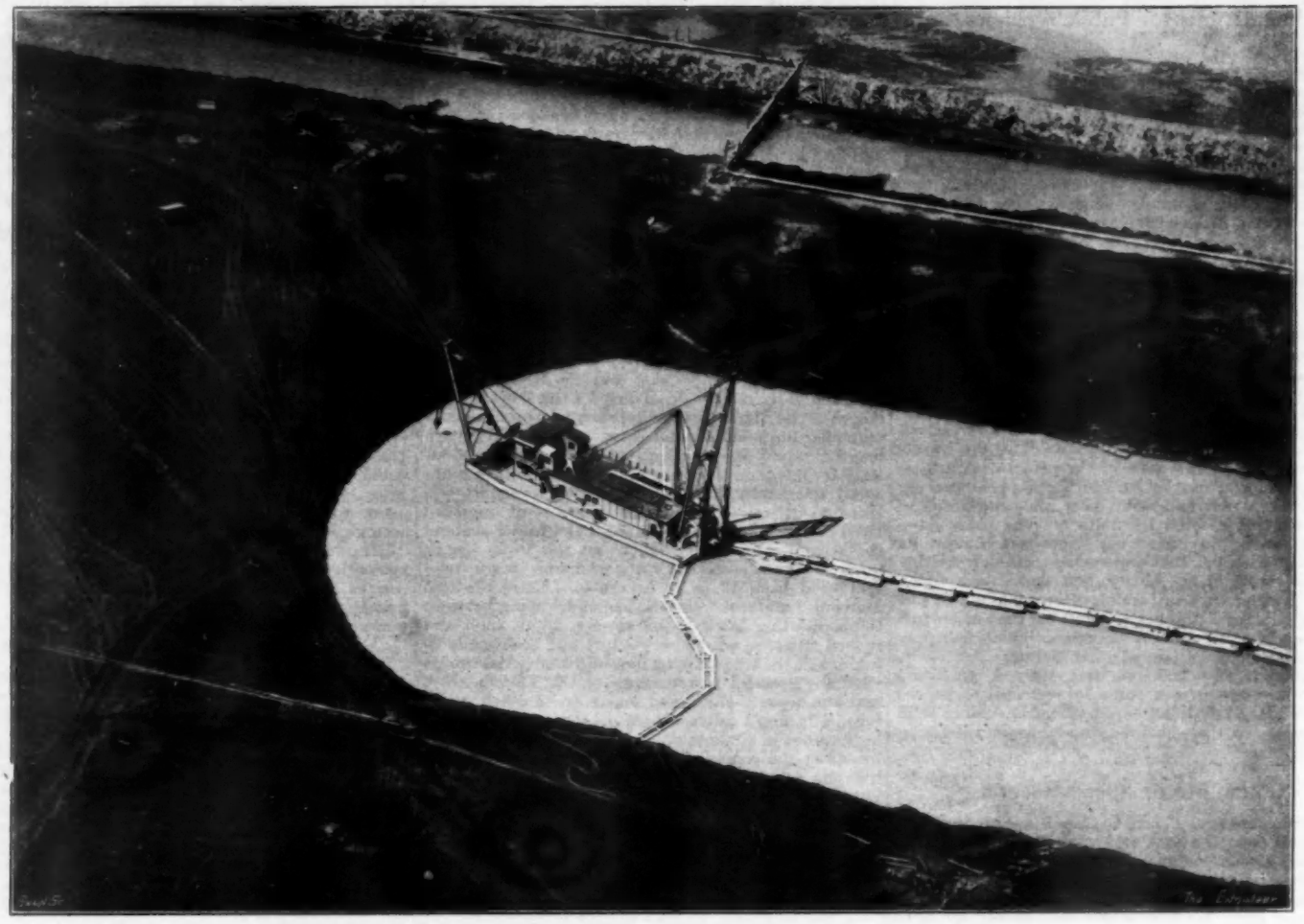
Workmen's Compensation Payments.

ACCORDING to official figures recently published, the total payments under the Workmen's Compensation Acts and the Employers' Liability Act amounted in 1929 to the sum of £6,569,918 for the group of seven industries embracing shipping, factories, railways, docks, mines, quarries, and constructional work. The sum above mentioned is only the actual amount paid to workmen and their dependents, and it does not include the total charge on the industries mentioned. If all the charges and expenses connected with compensation claims were taken into account the amount paid in 1929 did not, it is computed, fall far short of £8,500,000. The number of persons coming under the provisions of the Acts in the various industries above mentioned was 7,450,112, and there were 481,421 cases of compensation. The proportion of fatal cases was 12·3 per cent. of the total, and the percentage totals for the industries were as follows:—Shipping, 29·4; factories, 10; railways, 27·2; docks, 11·5; mines, 11·0; quarries, 17·0; and constructional work, 15·1 per cent. Of the actual aggregate payment of £6,569,918, 42·3 per cent. was paid by the mutual indemnity associations in the capacity of insurers, 22·8 per cent. by insurance companies, and 34·9 per cent. by employers, either directly or through the agency of mutual indemnity associations in respect of liabilities which were not covered by insurance. These statistics were recently published as a White Paper, and may be obtained from the Stationery Office.

The Late Mr. J. D. H. Dickson.

ON Friday, February 6th, Mr. James Douglas Hamilton Dickson, senior fellow of Peterhouse, died at Cambridge, at the age of eighty-one. Mr. Dickson was born at Glasgow in 1849, and as a student at the University of that city attracted by his brilliance the notice of Professor Sir William Thomson (Lord Kelvin), who employed him on important mathematical calculations, particularly in connection with research on electrical subjects. In conjunction with two others, Dickson constructed the apparatus and made the preliminary experiments for Thomson's determination of the ratio of the electromagnetic to the electrostatic unit of electricity. He also collaborated in perfecting Thomson's syphon recorder. He accompanied Thomson to France in 1869 in connection with the laying of the French Transatlantic cable, and when the work was completed he acted for a time as electrician in charge of the French company's station at Brest. Subsequently, on Thomson's advice, he resigned that post in order to proceed to Cambridge. He was admitted to Peterhouse as a Foundation Scholar in October, 1870, and in the mathematical tripos of 1874 was bracketed Fifth Wrangler. In October of that year he was elected to a Fellowship of his College, a position which he held for the remainder of his life, and in 1907, on the death of Lord Kelvin, he became senior fellow. From 1877 to 1897 he acted as tutor. During that time he interested himself actively in the researches on low temperature which were being carried out by his brother-in-law, Sir James Dewar. Subsequently he acted as one of the three literary executors entrusted with the publication of Dewar's collected papers. He wrote occasionally on scientific subjects, chiefly on thermodynamics and thermo-electricity, but it was as a tutor and as a coadjutor in famous researches conducted by others that he found his chief work.

THE BEAUHARNOIS CANAL—SUCTION DREDGER CUTTING CHANNEL



The Beauharnois Canal and Hydro-Electric Power Scheme.

No. I.

AMONG the important hydro-electric power schemes now in progress of being carried out in Canada, the Beauharnois development on the St. Lawrence River stands out prominently. Briefly told, the undertaking comprises the cutting of a canal, some 15 miles long, between Lakes St. Francis and St. Louis, so as to take full advantage of the difference in level between the two Lakes, and to allow a proportion of the flow of the River to pass through turbines driving generators—see Fig. 1.

In order to give our readers an idea of the position of the undertaking, we reproduce in Fig. 2 a sketch map of the St. Lawrence between Lake Ontario and Montreal. It will be observed that the map is divided into five sections by vertical lines. In the first Section—named that of the Thousand Islands—there is only a fall of 1ft. in 67 miles and no power is generated. In the next Section, which is 48 miles long and is known as the International Rapids Section, there is a fall of 92ft. and a possibility of developing 2,000,000 H.P. In the Lake St. Francis Section, which comes next, and which is 26 miles long, there is no fall. The Beauharnois Section comes next and in it there is a fall of 83ft. and a possibility of developing 2,000,000 H.P. In the Lachine Section, which is 23 miles long, there is a fall of 48ft. and a possibility of developing 1,000,000 H.P.

In the portion of the River between the two Lakes there is a series of four rapids: The Coteau, the Cedar, the Split Rock, and the Cascades, and the total difference in level between the two Lakes is 83ft. At the present moment, four hydro-electric stations are in operation on this stretch of river. They are:—(*a*) The Valleyfield works, which on the shores of Lake St. Francis, and which supply the energy required by Montreal Cottons; (*b*) the works of the Canadian Light and Power Company, which derives its power from water taken from the Old Beauharnois Canal; (*c*) the works of the Cedar Rapids Manufacturing and Power Company, which is actually built in the bed of the River; and (*d*) the works of the Provincial Light, Heat and Power Company, which take their water from the Soulanges Canal. All these stations make use of lower heads than with the Beauharnois development. The present scheme, which, we understand, will not infringe the rights of the other producers of energy, involves the use of the whole of this difference in level in one step by the formation of the canal above mentioned, so as to create a cut-off and to divert a portion of the flow of the River direct from Lake St. Francis to a point adjacent to and immediately above Lake St. Louis.

The history of the undertaking goes back 130 years or so to the time when the then Seigneur of Beauharnois erected a small grist mill at the mouth of the St. Louis River, where it discharges into the Lake. Finding the flow of the river too small to operate his mill, the Seigneur excavated a small feeder canal capable of carrying only quite a small volume of cusecs from Lake St. Francis to the head waters of the St. Louis River to increase the flow, and thus, for the first time, diverted water around what is known as the Soulanges, or Beauharnois, section of the St. Lawrence. The St. Louis River is still generating hyrdaulic power at Beauharnois, and the original diversion rights, under which the small canal was excavated, are still in existence. After passing through several hands, during which period additional rights were obtained possession of, all of these rights were acquired by the Beauharnois Light, Heat and Power Company, which was formed in 1902 for the purpose. Subsequently, the assets of the company were purchased by Mr. R. O. Sweezey, and, later still, the company became a constituent part of and is now controlled by the Beauharnois Power Corporation, Ltd., which is carrying out the present work. Mr. Sweezey is the president of this company, with Mr. R. A. C. Henry as vice-president. In 1928, applications were made to the Quebec Government for authority to change the charter, so as to obtain sufficient water to make the present project economically possible and to divert it directly into Lake St. Louis. The provincial Cabinet and the legislature gave the matter their support. As, however, the proposed development was to take place on a navigable river, it was neces-

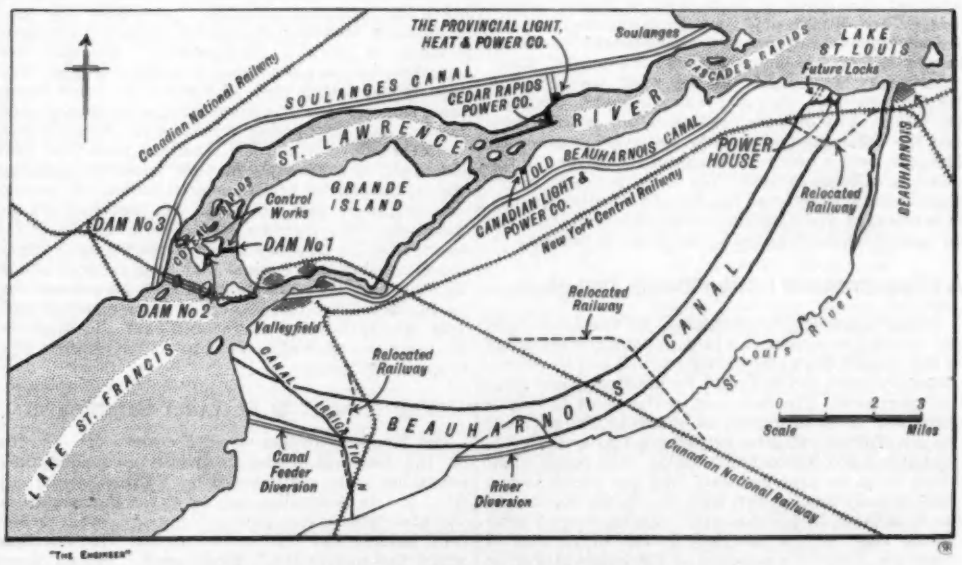


FIG. 1—SKETCH MAP SHOWING ROUTE OF BEAUHARNOIS CANAL

sary, also, to obtain the authorisation of the Federal Government. That was applied for, and in March, 1929, a Federal Order-in-Council granted to the Beauharnois Light, Heat and Power Company the required authorisation, with certain provisions, and in September of that year, the Beauharnois Power Corporation was formed to own all the shares of the Beauharnois Light, Heat and Power Company and other subsidiaries, each of which plays a part in the development of the project.

Before going any further, a few words concerning the river St. Lawrence may be interposed. The average flow in this stretch is given as being 220,000 cubic feet per second, though, at times, the flow is as much as 325,000 cusecs, or more. The rights of the Valleyfield concern have been acquired by the Beauharnois Corporation, but the other three works require a total flow in the River of 65,300 cusecs. They, between them, it may be explained in passing, produce some 260,000 horse-power, whereas, were the same volume of water to fall through the 83ft. drop of the Beauharnois scheme, 700,000 horse-power, or between 2½ and 3 times as much energy, would be developed. That, however, is by the way, since, as explained above, the rights of the existing concerns will not, at present, at any rate, be interfered with, though we revert to this point later. When the Beauharnois scheme has reached a state of development at which it can distribute 400,000 horse-power, it will require a flow of 53,000 cusecs. That would mean, with the other three stations in full operation, a total flow of 118,300 cusecs, and it would still leave some 1,000,000 cusecs, on an average, flowing down the River to waste.

The plan at present is to build a power-house at Beauharnois sufficiently large to house ten generating units, each of 50,000 horse-power, so that the capacity will be 500,000 H.P. That, however, is only the first stage, for, eventually, the house, it is proposed, is to be made large enough to contain machines capable of developing, as a total, 2,000,000 horse-power, and when that is done it will be, it is said, the only station in the world which will have a potentiality of developing that amount of hydro-electric energy under a single roof. At first, it is not even sought to install the full 500,000 H.P., for the first section of the power house will only contain four units, each of 50,000 H.P., and it is hoped to have them in operation by October 1st, 1932. The original power house is to have a length of no less than 1000ft., but when the housing of the forty 50,000 H.P. units, to generate the full 2,000,000 H.P., is complete, the building will be as much as 3000ft. in length.

The 2,000,000 H.P. would, it may be remarked, take up the full flow of the river, but that is the eventual power for which the station is designed, and it would look as though it were intended to acquire at some future time the rights of the companies at present operating, in spite of what has been said above as to the present purpose. Indeed, there appears to exist a possibility of transfers somewhat similar to that of the Valleyfield rights, or some form of co-operative effort, whereby a more economic use would be made of the existing water rights in the river.

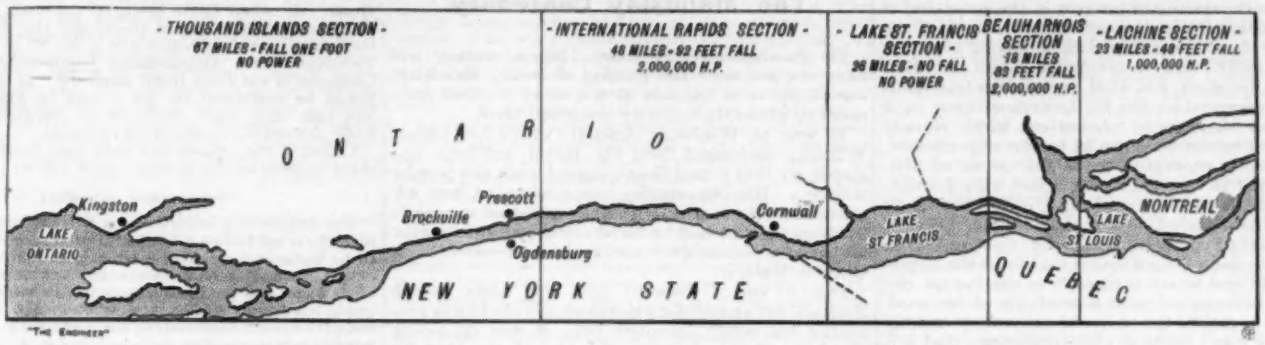
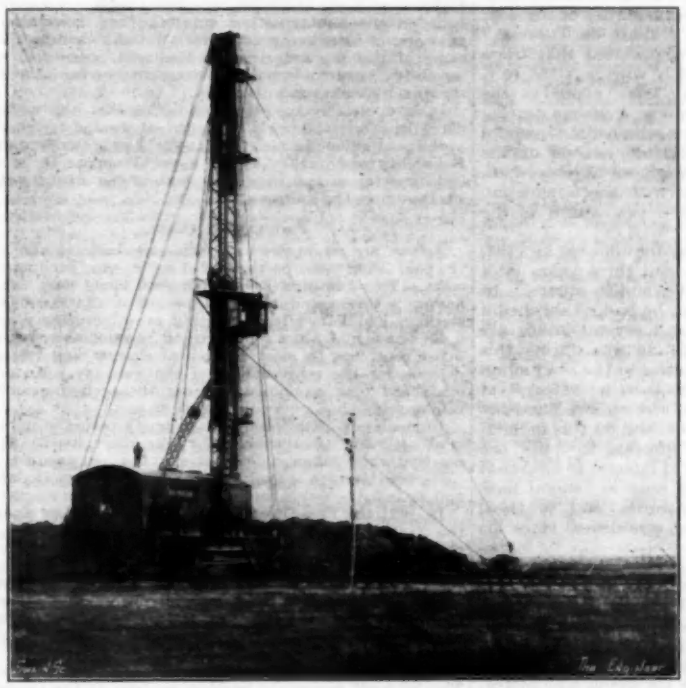


FIG. 2—SKETCH MAP OF THE RIVER ST. LAWRENCE BETWEEN LAKE ONTARIO AND MONTREAL

The entrance to the new canal is on the southern shore of Lake St. Francis, a mile or two away from the township of Valleyfield. The line followed by the canal is not straight, being on a wide curve, so as to pass through the most favourable contours of country. It is rather over 15 miles long, and, in that, the scheme, curiously enough, resembles the Lochaber undertaking, in which, it will be remembered, there is a tunnel just over 15 miles long. But, there, all similarity ceases. Instead of a tunnel, there is to be a canal 3000ft. wide, and instead of a fall of 800ft. for the water there is only to be a drop of 83ft.

A feature of the canal is that it will, for by far the greater part of its length, be contained between dykes or embankments as the existing levels along the greater portion of the total distance lie from 3ft. to 15ft. below the level of the head waters of Lake St. Francis. Only for a length of some 400 yards or so does the level of the ground rise above those head waters. Although, at first, it is not proposed to excavate the canal to the full extent of its designed width of 3000ft., the dykes or embankments are being



FIGS. 3 AND 4—130 FT. TOWER-EXCAVATORS WITH 10-CUBIC YARD BUCKETS

There would also appear to exist a possibility of further expansion of the project by the diversion of more water direct from the river. That such an event was foreseen from the outset is evidenced by the fact that the canal is of sufficient designed width to take the whole flow of the river.

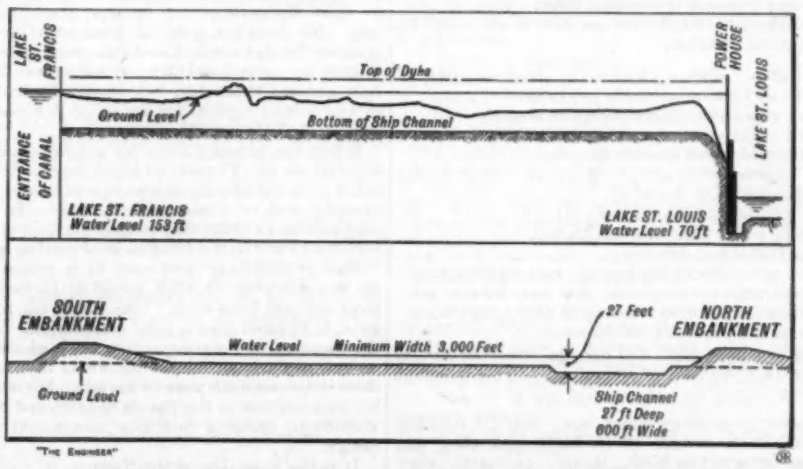


FIG. 5—DIAGRAMMATIC LONGITUDINAL AND CROSS SECTIONS OF CANAL

constructed to the full width apart necessary for the final development, the maximum general height of dyke being 22ft. The water from the lake, however, will extend to both canal dykes—see Fig. 5.

One of the stipulations made by the Federal Government, in granting the request for powers to undertake the works, was that navigation should be regarded as the dominant interest in the river, and it therefore insisted that throughout the length of the canal there should be a ship channel having a bottom width of 600ft. and a minimum depth of 27ft. Another stipulation was that certain control dams should be arranged in the St. Lawrence River as it leaves Lake St. Francis. A bottom width of only 150ft. is at present being given to the ship channel, but it is being excavated to its full depth of 27ft. Fortunately, but very little rock is met with throughout the length of the canal, and it is possible to excavate almost the whole of the material by means of an electrically operated hydraulic dredger. The dredger—see page 188—which is said to be the largest in the world and which is capable of cutting its own floatation, is furnished with a revolving cutter head, adjustable in depth, the material excavated—mostly marine type clay—being of such consistency that it is easily removed by suction and pumped through pipes to the sides of the canal, so as to be deposited behind the embankments. The latter, having regard to the width of the canal and to the amount of material which will, eventually, have to be excavated, will, in effect, be made very much wider than is actually required in good engineering practice. Throughout the whole length of the canal there is no rock cutting, except at the power house, but for a length of about a mile and a-half there is boulder clay, and that is being dealt with by 4-cubic yard and 5-cubic yard dragline excavators carried on caterpillars. By the end of last year nearly 11,000,000 cubic yards of material had been moved, but for the initial installation of 200,000 H.P. as much as 30,000,000 cubic yards will have to be moved. For a short length, at a point some 4 miles or so to the east of Lake St. Francis, where the ground level is above the top water level of the Lake, a small amount of excavation above ground level will have to be carried out, in order to allow the full width of the canal to be flooded when water is admitted from the Lake. At present the Lake is prevented by dykes from overflowing its banks at the site of the entrance of the canal.

Active operations were started at the beginning of August, 1929. During the remainder of that year work of a general character was carried out. It included the erection of the camps, the assembling of the hydraulic dredger, which is, as has been said above, one of the largest vessels of its kind in the world, the formation of some miles of dyking along the route of the canal, and the building of the first few miles of the construction railway, which, by the end of 1930, had reached a total length of track of some 40 miles. The dredger was put together in a pit excavated near Lake St. Francis, into which, when the vessel was ready, water was admitted from the Lake.

During last year, the major construction work was begun with the assembly and erection of the large-scale equipment, which had been specially designed to handle the types of material encountered along the route of the canal and at the power-house site. This large-scale equipment, which, we are informed, cost more than £800,000, enabled the Corporation to carry out the work on a mass production basis with a corresponding reduction in excavating costs. To obtain maximum economies from this costly equipment, operations are carried on both day and night. In the summer of 1930 more than 2000 employees were on the pay roll. In addition, orders given by the Corporation for constructional material and plant afforded employment to another 3000.

The equipment employed on the work may be summarised as follows :—

One 26in. electric-hydraulic dredger with a capacity of 1100 cubic yards per hour.
Ten ¾ cubic yard petrol dragline shovels.
One 4 cubic yard electric dragline.
One 5 cubic yard electric dragline.
Six tower excavators with 10 cubic yards buckets—see Figs. 3 and 4.
One 8 cubic yard electric shovel.
One 1¾ cubic yard electric shovel.
Four travelling derricks.
Forty miles of standard gauge, rock ballasted construction railway, six 8-ton and two 35-ton stiff-leg derricks, with fifteen 45-ton saddle-tank locomotives and 130 pieces of rolling stock.
Rock crushing, sand making, and concrete mixing plant with a capacity of 100 cubic yards of concrete per hour.

The tower excavators which were used for forming the dykes have towers 130ft. high, and they can operate as far apart as 900ft., though, ordinarily, they work at a distance apart of about 750ft. Furthermore, the Corporation erected, at Beauharnois, its own dock, a fuel oil tank with a capacity of 20,000 barrels, completely equipped hospital, cement storage bins, warehouses, a forge for making drills, a compressor house, a powder magazine, and five camps along the route of the canal, the main camp being at the power house. About 28,000 acres of land, embracing some 250 farms, have been acquired along the canal route. Of the total amount, about 8000 acres are required for the canal itself.

(To be continued.)

The Maudslay Centenary.

On Sunday next, February 15th, a century will have elapsed since the passing of Henry Maudslay, one of the most eminent of the many eminent engineers to whom this country has given birth.

It was at Woolwich Arsenal, where his father, William, discharged from the Royal Artillery, was employed, that young Henry started work as a powder monkey. His opportunity came when he was admitted into the smithy, where he progressed so rapidly in the craft that had he lived a few centuries earlier he would undoubtedly have become as renowned as Quentin Matsys.

But it was a different age, and when Joseph Bramah cast around for a workman to help him in producing his newly invented lock, it was on young Maudslay, then only eighteen years of age, that his choice fell. It may be said that it was to Maudslay's practical skill in making the machines for turning out the locks on a large scale that the success of the invention was attributable. Another of Bramah's inventions, the hydraulic press, became widely serviceable only with the addition by Maudslay of the U-leather packing.

While still employed by Bramah the slide rest for the lathe was brought out. The device was not new, as it was known to the ornamental turner of the day, and is illustrated in Plumier, "L'art de Tourner" (1754), and elsewhere. It is also stated that there was a boring mill at Woolwich with a slide rest. Even admitting that Maudslay knew about it, the combination with a leading screw and change gearing brought into being a self-acting machine tool of general workshop use that may be classed as one of the greatest gifts the mechanical engineer has ever had, parallel at the lowest estimate with the application of the crank and connecting-rod mechanism to the steam engine.

Maudslay started in business for himself in 1797, in Wells-street, Oxford-street, and three years later removed to Margaret-street, Cavendish-square. In a small way with one workman, he had established a reputation as a tool maker, and several lathes are extant to witness to his skill. It was during this period that he turned his attention to the production of screwing tackle. There was then no attempt at uniformity in thread or pitch of screws, but Maudslay brought some order out of chaos, and on this foundation his pupil, Whitworth, afterwards built the present standard system. It is of interest to note that the pitches used by Maudslay were in general finer than those adopted by Whitworth, and to these certain branches of engineering established since his day have adverted.

A great opportunity came when Marc Isambard Brunel required someone to execute his designs for block-making machinery for Portsmouth Dockyard. His attention was drawn by a compatriot to Maudslay, and it may safely be said that the conception and ingenuity of Brunel, the constructive and manipulative skill of Maudslay, and the far-seeing administration of Sir Samuel Bentham were alike vital in bringing about this vast innovation in manufacture, the savings of which in one year over the older method of making blocks by hand was estimated at anything from £17,000 upwards. The models of the machines are still preserved in the Royal Naval Museum at Greenwich.

The satisfactory execution of this job brought accession of fame and business to Maudslay, so much so that Margaret-street became too straitened for him. He found a piece of land abutting on Westminster Bridge-road, Lambeth, with premises, and thither he moved in 1810. His business became of a very general character, but always he had a leaning to the steam engine, for he secured a patent of his own in 1807 for a table engine.

When the demand arose for marine engines he was the first on the Thames to build them. We need not enter into details, as it was the influence of his son Joseph, and of Joshua Field, whom he took into partnership in 1822, that placed the firm of Maudslay, Sons and Field in the front rank of marine engineers.

Henry Maudslay was cast in a generous mould. He was well over 6ft. high, broad in the face, with high forehead and keen eyes. Like many big men, he was good humoured and a jolly companion. He died on the morning of February 15th, 1831, of a cold caught on returning from one of his visits to France, being then in the sixtieth year of his age. He was buried at his own request in the parish churchyard of St. Mary, Woolwich, under a cast iron monument of his own design.

It is the intention of the Newcomen Society for the Study of the History of Engineering and Technology to lay a chaplet on the monument on this centenary of his death. This ceremony will be preceded by a memorial service, to be attended by the Mayor and Council, in Woolwich Parish Church at 11.30 a.m., to which all engineers are invited.

Wages and Working Conditions in the Engineering Industries.

On Friday, January 30th, a special conference between the Engineering and Allied Employers' National Federation and various trade unions was held in the Great Central Hotel. Sir Allan Smith occupied the chair and made a statement which occupied practically the whole time of the session. At the conclusion of it, Mr. W. H. Hutchinson, President of the Amalgamated Engineering Union and Chairman of the Joint Body, promised that the statement would be considered by the unions on February 24th, and that they would probably be prepared to bring a reply forward in the first week of March.

Copies of the proceedings have been issued, and from them we abstract the passages which follow.

Engineering Industry.

The engineering industry is a finishing industry, and, as such, is subject to a burden of pre-charges which have to be borne in the field of international competition to an extent exceeding that borne by any other industry. High wages and production costs in coal mining, iron and steel, transport, and in the whole range of sheltered industries react immediately and repeatedly on the engineering industry and on those engaged in it.

Municipal rates are high, largely because municipal employees are paid rates of wages which cannot be justified either under economic or competitive conditions. They are also high because the relief works are undertaken at unreasonably high costs. The engineering industry has to make its contribution towards the maintenance of these high costs to the disadvantage of the industry and those engaged in it.

It might be a good thing if the workpeople who are directly engaged in exporting industries were to get together with the employers and bring some influence to bear on the non-exporting industries and occupations who are, in fact, living on them. Notwithstanding that some of you are concerned in sheltered industries, we seriously suggest to you that in your engineering interests some such endeavour is necessary.

It is upon the exporting industries that the nation depends. Only the world price can be secured for goods in the production of which there is world-wide competition. Reliability and quality at the moment appear to be of less importance than they were, and, in the main, to the cheapest goes the contract.

Production Costs.

As you are aware, we have made available to you for the past seven years particulars of engineering production costs. These returns as at this date show that firms having a turnover during that period of £2,000,000,000 sterling, had left, after deducting manufacturing costs, a net balance of 3 per cent. It will be remembered that 3 per cent. has to meet all capital charges and has to provide for the rejuvenation of the industry. No one could say that an industry under those circumstances is in anything but a very serious position.

Immediately after the war there was a period of industrial activity, but that activity was short lived. The reaction which followed demonstrated that our production costs were too high to enable us to compete internationally and we failed to retain some of our former foreign markets.

In 1921 the Federation was seriously concerned about the state of the industry, so much so that in that and in the succeeding year we had to ask you to consider with us reductions of wages in the hope that thereby production costs would be so reduced as to enable us to compete successfully with foreign manufacturers. We have found that even with the wages reductions which were then operated and with the strictest economy in manufacture, we have not been able to compete.

Our costs are higher than those of any other country. This of itself presents a problem so long as the present conditions continue, but it also presents a problem of greater gravity. When an improvement takes place in the world's markets, we, on account of our costs, must obviously be the last to participate in that improvement. In other words, until we are able to produce a cheap article, we shall require to wait until world buyers are prepared to buy a good article. The position is rendered more difficult from day to day as we see our foreign competitors effecting reductions in their wages, their costs and their selling prices.

In a mood of optimism immediately after the war, we signed agreements on November 19th and December 24th, 1918, restricting the day shift hours of work to 47 hours per week.

As the result of two agreements the hours were reduced to 47 hours per week from an average of 53½, a reduction of 6½ hours per week without a reduction in the weekly rates. The hourly rate of pay was accordingly increased in proportion and in the case of the skilled men by about 14 per cent.

On the anticipated effect of the reduction of hours on production, the following statements made by your chairman are instructive.

At a conference on November 1st, 1918, he said :

> "I am here to-day, Sir Allan, to state definitely that in my judgment and in the judgment of those here and those whom we represent, by reducing the hours of labour to 44 per week, there is going to be no diminution of output. . . . I am here to state that I am satisfied in my own mind that by a reduction of the working week to 44 hours without reduction in wages the trade which we represent will not suffer in any material degree."

Again, on November 19th, 1918, he said :

> "There is no doubt whatever in my mind that the reduction of hours from 54 or 53, as the case may be, to 48 will not be accompanied by a diminution of output."

On this he was supported by Mr. John Hill, Mr. Will Thorne and Mr. Frank Smith.

So much for the obligation. Now for its discharge.

The following quotation from the report of the Committee on Industry and Trade gives the officially stated experience of the Federation :—

> "Statistics obtained shortly after the alteration of

working hours indicated that, considering engineering in general, the fall of output had, in a number of instances, been proportionately greater than the reduction of hours. A representative of the Employers' Federation who gave evidence in 1925, estimated the loss of output at that date at from 10 to 15 per cent., and further asserted that the output per man per hour was less than the pre-war standard. A witness giving evidence for the Agricultural Engineers' Association, in November, 1924, indicated that while the workers in the companies with which he was connected had lately effected a considerable improvement of output, there were still possibilities of improvement. The evidence in connection with the manufacture of locomotives, in June, 1925, was that generally the reduction of output had been equal to the reduction of hours. Evidence on behalf of the British Cycle and Motor Cycle Manufacturers' and Traders' Union was to the effect that in 1925 the output of labour was from 10 to 20 per cent. below the output in 1914."

On the question of costs, the following further quotation from the report of that Committee confirms the position of the Federation :—

"But, meanwhile, there have been forces working in the opposite direction, *e.g.*, the more efficient organisation of production, the adoption of more mechanical aids to industry and the changes which have taken place in the proportions of women to men and of semi-skilled to skilled labour. It is not possible to measure the effect of each of these forces separately, but it seems probable that the last-named group of factors must have at least balanced, if not out-weighed, those previously mentioned. In any case, it is fairly certain that, after taking them all into account, we have still to seek for some residual factor capable of accounting for at least part, and possibly the greater part, of the observed increase in the real cost of labour in production. It is difficult to resist the conclusion that this residual factor is the reduction in the length of the working week which has taken place between the dates we are comparing. This reduction while affecting different industries differently, has, on the whole, averaged about 10 per cent., and it seems clear that, speaking generally, it has not been fully offset by increased productivity per hour."

The agreements had not been long signed before it was claimed in some cases that the reduction in hours affected the earnings of the men, and adjustments up to 15 per cent. were made in piecework prices. This was done by the employers in their desire to make the agreements a success, and it was done notwithstanding that the unions had promised that the output would be maintained on the shortened week. The unwisdom of this action has since been fully demonstrated.

Hours of Industrial Employment Bill.

With regard to the question of the Hours of Industrial Employment Bill, this Bill proposes a maximum week of 48 hours, or 8 hours per day, with a restriction of overtime beyond what is at present in operation, and with an absence of the necessary elasticity which at present exists.

Under such conditions as will result from the legislation proposed, experience indicates that there cannot fail to be a high and increasing cost of production. It is not necessary to elaborate the difficulty which will arise even if the hours legislation is applied to all countries. The method of application and enforcement will never be uniform, and, in fact, longer hours than 48 are provided for in the case of Eastern nations, whose competition with us is becoming a very serious problem.

It is, therefore, necessary that the present working week should be extended to 48 hours so that the industry should have full advantage of the proposed legal maximum, and for this purpose the present weekly wages should not be affected. This is merely the counterpart of what was done in the 47 hours agreements.

Overtime, Nightshift and Shifts Agreements.

Following on the 47 hours agreements, negotiations were commenced with the unions on the question of overtime and nightshift and double dayshift and three-shift systems, and an agreement was arrived at on the first two subjects on September 29th and 30th, 1920, and on the third subject on December 9th, 1920.

With regard to overtime, up to September, 1920, the practice regarding payment for overtime in engineering establishments had varied, and the agreement provided a national basis of time and half until midnight and double time thereafter. The variation ranged from time and quarter throughout to time and half throughout. The average was rather lower than time and quarter for the first two hours and time and half thereafter.

Experience has also shown that throughout the period since the agreement was entered into, contracts have been lost on account of the cost of the necessary overtime. Further, it must be kept in mind that where orders have been taken and overtime has been required for reasons which could not be anticipated, or in greater measure than had been anticipated, the cost of such increase of overtime has had to be looked upon as an unanticipated charge and, therefore, as a definite loss on production. The reasons which in 1920 appeared to be good for doing what was done have since proved to be unjustified, and the conditions then agreed upon now require modification.

The principal purpose of the present approach on the question of overtime, as in the case of the other items of working conditions now being reviewed, is to enable the industry to procure a greater amount of work.

It is, therefore, proposed that overtime should be computed after a full week, and should be paid for as to to the first four hours in any day at the rate of time and quarter, and for the remainder at time and half.

The general remarks which introduced the question of overtime equally apply in the case of nightshift, which forms the second portion of the agreement of September 29th and 30th, 1920.

The nightshift hours also varied considerably, broadly, from 45 hours to 60 hours per week, with an average of about 50 hours. Under the agreement the nightshift hours are 47. It will be remembered that in terms of the 47 hours agreement, nightshift payment is based on the enhanced hourly day rate due to the reduction of hours to 47.

In the case of nightshift, as with overtime, we have had many instances where contracts would have been procured but for the extra cost of running the necessary nightshift.

But there is a point in relation to nightshift which distinguishes that system from overtime. Overtime, although it is necessary in certain cases, does not give additional employment. Nightshift does. The essence of nightshift is to spread the work over a greater number of men and, by greater continuity and better balance, to cheapen production. At a time like the present, other things being equal, nightshift on that account would appear to be the preferable method of production. To that extent there is, perhaps, greater reason why nightshift should be made more attractive from the point of view of cost than it is, so that a greater inducement to spread work over a greater number of men would result.

As in the case of the overtime provisions of the agreement, equally so with the nightshift. For the reasons which have been adduced in relation to overtime, as well as the reasons given in relation to nightshift, it is necessary that the nightshift conditions should be amended.

The proposals with regard to nightshift are twofold.

Firstly, the period of time occupied on nightshift differs from that on dayshift. A nightshift of the present duration requires a start later than is reasonable from the point of view of the work and the equipment so as to enable the nightshift man to return home at a reasonable hour. If the nightshift starts earlier for the purpose of coupling up with the dayshift, a nightshift man will have to return home at an hour when travelling facilities are few, if they exist, and the hour is inconvenient from the point of view of ordinary domestic arrangements. There would, therefore, appear to be no reason why the hours of nightshift should not be extended. The nightshift man would thereby be enabled to increase his earnings, even were the allowance reduced, and he would be able to do so in hours which would not affect the ordinary amenities of his life.

Secondly, as has been shown, the nightshift man has received substantial benefit in the effect of the 47 hours agreement, and it is, therefore, not unreasonable that his rate for nightshift should be the day rate plus one-ninth.

The payment for overtime on nightshift should not exceed that on dayshift, namely, for the first four hours in any night, time and quarter, for the remainder, time and half, calculated on day shift rates. For the purpose of computation overtime on nightshift should only be paid after the full nightshift week has been worked.

As in the case of overtime, there will be some necessary consequential adjustments in the 1920 agreement.

With regard to the double-day and three-shift system, the agreement with the Amalgamated Engineering Union, dated December 9th, 1920, is the only agreement the Federation has on the subject.

As in the case of the 47 hours agreement, to which I referred, I should like in this case also to direct your attention to the preamble. The first provision of the agreement :

"The introduction of the system shall be for the purpose of absorbing unemployed."

For the purpose for which this agreement was instituted it has proved a failure, the cost involved being prohibitive.

If an agreement is arrived at for the purpose of dealing with unemployment, it appears to be out of the question that the general rule of paying men for the hours they do work should be varied either from the point of view of general policy or in the manner in which the agreement provides, namely, in effect, guaranteeing for the shortened shift a full 47 hours pay to all employed and thus paying them for hours that they do not work.

Demarcation.

A subject of much difficulty arises out of conflicting claims of skilled classes themselves to do particular operations.

The unfortunate position which arises is that in most cases an intimation is given to the employer that unless he removes the men doing the job and replaces them by another class represented by the union raising the issue, the members of the union making the claim will cease work and will continue to do so until the employers make the change desired.

It will be appreciated that immediately the employer complies with the proposal, he runs the risk of conflict with the union representing the men who have been displaced. Such a cessation of work may not be confined to the particular works. It may spread over a whole area. This, of course, has immediate reactions on other classes of men in the same industry, and frequently immediately, and always eventually, on men in other industries. It is an expanding circle.

No doubt it is the prerogative of the unions to look after what they conceive to be the interests of their members, but it would seem that sufficient time has now elapsed to convince the various unions that on such questions it is not much to their advantage to risk a stoppage of work.

Difficulties of this description have proved susceptible to suitable procedure for settlement. Not only does action of this description hold up production, but it increases the cost of production, and, having regard to the fact that these difficulties are practically unknown in the factories of our foreign competitors, the present would seem to be an appropriate opportunity for arriving at an agreement which would provide a means of settlement of such questions without incurring unnecessary and expensive stoppage of work or delay in completion.

It does not appear that satisfaction can be secured in questions of this description unless the employers are a party to any arrangements made. The difficulty is not a difficulty created by the employer ; it is a difficulty created by a union for the purpose, presumably, of saving or acquiring work for the craft which the union represents.

We submit that an arrangement such as that contained in the agreement of 1912, which has proved its efficacy, should be extended to include all questions of demarcation that may be raised.

Interchangeability of Workpeople.

The logical result of a consideration of demarcation difficulties and of the position I have outlined in relation to the manning of machines and hand operations, is acceptance of the principle of the interchangeability of workpeople.

The complex nature of engineering production has arrived at a stage when it will be necessary to avoid the overlapping of operations which has become so frequent.

The problem which affects machines is equally pressing in connection with hand operations. Machining has arrived at such a stage of perfection that much fitting is avoided. For example, in the erection of machinery on site, much of the work prepared by the skilled men in the works is so readily identifiable as to position and function as to take the form of assembly work rather than skilled erection. Again, there are many operations which could perfectly well be done by an engineer which are held up for a considerable time occupied in securing the services of a bricklayer or a carpenter. There are many operations completely done by men trained to a certain extent in several crafts. But, frequently, on erection jobs, craftsmen have to be available waiting their turn to do their special portion, while others stand by. There are many fitters who serve their time to fitting and turning, and *vice versâ*, and each may spend a certain time in the pattern shop. There are many boilermakers who have served their time to all branches of boilermaking and have, thereafter, specialised, and there are cases where men trained in one class of work have a useful knowledge of other classes.

In cases where interchangeability has taken place, we have found that a very substantial saving has been effected in the cost of particular operations, not only from the point of value, but also from the point of time occupied.

Our foreign competitors are not subject to such restrictions, and there are many instances where the difference in practice has lost us contracts. Many instances bearing upon this question are available. It is not an unfamiliar point to you, and we are of opinion that it requires consideration as an important element in the reduction of costs.

Payment by Results.

With regard to payment by results, when the 47 hours agreements were entered into, one of the conditions was, as you will remember, that no change should be made in piecework prices or lieu rates. We do not recognise lieu rates, but we are aware that there are cases where they exist. Although this is one of the terms of the agreement, we did, in fact, increase certain piecework prices so that earnings should not be decreased. Further, we made a new agreement with some of you on April 1st, 1919, conceding the principle that prices should be so fixed as to enable a man of average ability to earn 33⅓ per cent. on his base rate instead of 25 per cent., as had been the practice, and this principle was embodied in subsequent payment by results agreements.

The agreements at present in operation on this subject are so expressed as not to adequately meet the present method of operating such systems, and we think that they should be revised and, in particular, include a clause relating to adjustment of piecework prices or bonus times in the following terms :—

"Prices and bonus times, once established may not be altered, except for the following reasons :—

"(*a*) A mistake in the calculation on either side.

"(*b*) The material, means or method of production, or the quantities are changed, or

"(*c*) A mutual arrangement has been come to between the employer and the worker in the same manner as a new price is arranged."

We also propose that the percentage of capacity to earn, agreed or recognised, shall, in cases where it exceeds that amount, be altered to 25 per cent.

Questions arising out of this proposal will be appropriate for discussion when the point comes up for consideration in the course of these proceedings.

Wages.

Now we come to a point which is of such importance that you may have thought it should have been referred to earlier in the proceedings.

With regard to wages, we will be prepared to consider the question in the light of the adjustment in working conditions ; but it is necessary to impress upon you that if we cannot secure prompt and adequate relief for the industry from adjustments, of the working conditions, or if the present depression is prolonged or is intensified, we shall be compelled to ask you to confer with us on the general wages question. Further, the adjustment of the working conditions may of itself involve adjustments of wages, or other methods of remuneration, and these will require to be dealt with in conjunction with the working conditions in question.

In the meantime, we desire you to understand that we look upon the following questions as matters of urgency, so that some immediate and direct relief may be afforded to the industry :—

(1) the working week ;
(2) overtime ;
(3) nightshift ;
(4) double-day shift and/or three-shift system;
(5) payment by results.

We regret the circumstances which have made this approach necessary, but, having regard to the position of industry and to the extent to which the employers have had to carry the financial burden during the whole period of the depression, we feel justified in saying that we are not proposing anything which may not be looked upon as a reasonable contribution by the workpeople towards the solution of the present difficulty.

If, however, you and your members fail to make your contribution, the employers will be left with no alternative but to take what steps they consider necessary.

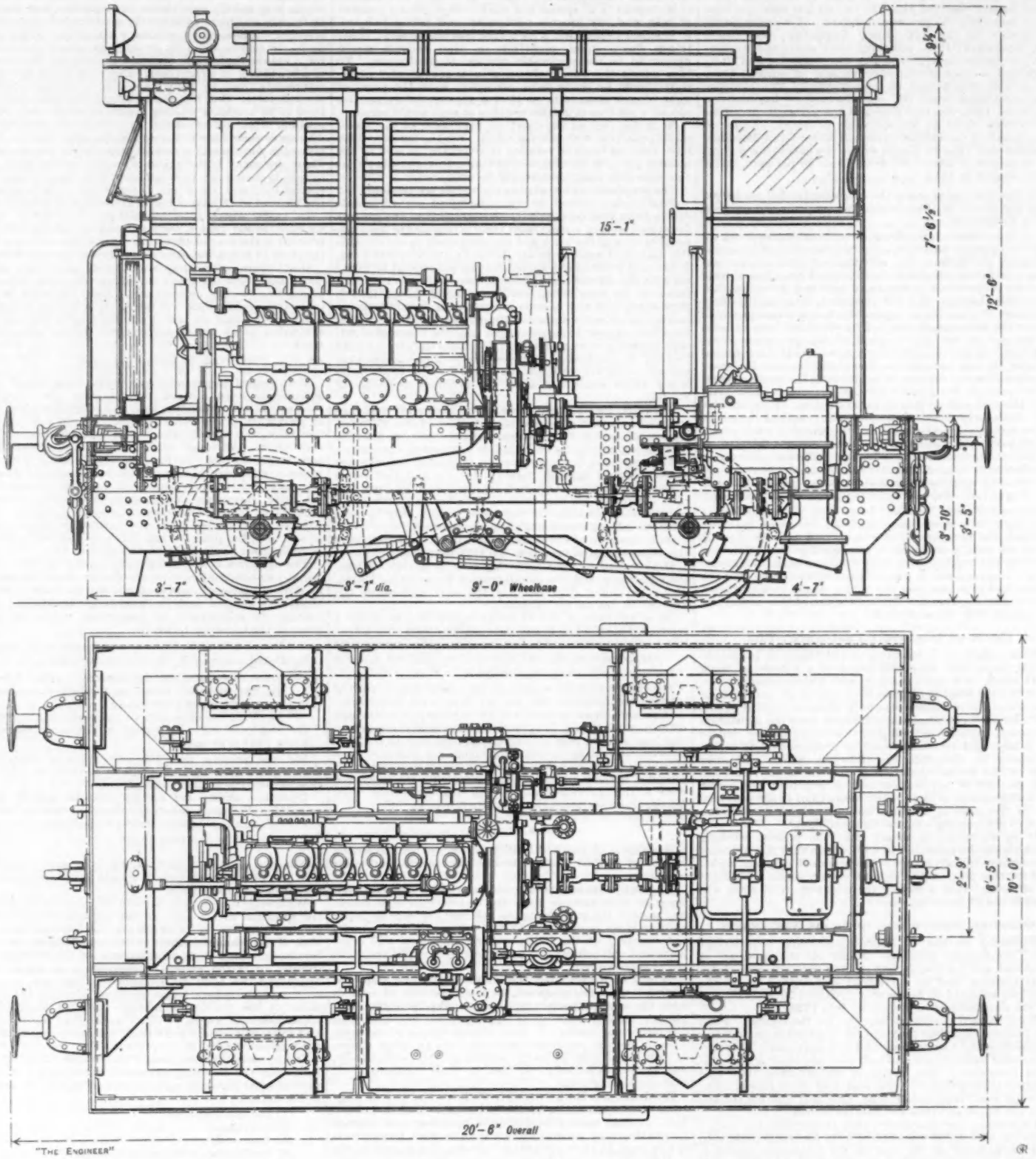
The industry has never faced such a crisis. If an effort is made for the purpose of recovery in the industry jointly and with the goodwill of both employers and workpeople, the chances of speedy and lasting benefit to all are immeasurably great.

But the effort cannot and must not be delayed by any lack of co-operation.

I therefore commend what I have put before you to-day to the most earnest consideration of your members so that, when deciding their policy, they may have due regard to the declining position of the industry and the possibility of its relegation to a subordinate position, instead of occupying the position of the premier manufacturing industry of the world, a position which, up to the war, it maintained.

100 H.P. OIL-ENGINED SHUNTING LOCOMOTIVE FOR THE ARGENTINE

D. WICKHAM AND CO., LTD., WARE, ENGINEERS



100 H.P. Oil-Engined Shunting Locomotive.

RECENTLY we had an opportunity of studying at work on an experimental track an oil-engined shunting locomotive of rather unusual design—it was necessarily on an experimental track, as the engine is of 5ft. 6in. gauge and, consequently, could not be given a long run. That is not, however, of much import in shunting operations, and the tests which we gave it were assimilated to the conditions prevalent in a shunting yard. The engine, which fully satisfied us in these directions, is one of two which are being supplied to the Central Argentine Railway by D. Wickham and Co., Ltd., of Ware. We give some illustrations of these engines in the accompanying drawings.

The outstanding features of the locomotive are that it is driven by a heavy oil engine, of the McLaren-Benz type, that it has a novel change-speed gear-box, and that the axles are of the full-floating type.

The engine itself has already been described in THE ENGINEER of March 7th, 1930, so it is unnecessary to describe it in detail here. It is of the solid injection type, and is noteworthy on account of the fact that it can be throttled down very considerably and still give a good torque—a great advantage in shunting work. It has six cylinders and develops 90 horse-power when running at 800 revolutions per minute, but may be speeded up to well over 100 horse-power. In view of the probability of the locomotive being put in the hands of rather inexperienced drivers, and the fact that the conditions of service will probably require many stops and starts, the usual system of starting with compressed air has been changed for one in which a two-cylinder petrol engine, of the motor cycle type, is connected with the main fly-wheel, by means of a friction wheel. This little engine can, of course, be easily started by hand and will run on indefinitely until the main engine gets away. The engagement of the friction wheel is made by rocking the whole starting engine on a cradle by means of a hand lever, and so soon as the main engine picks up speed it overruns the starter, which drops out of action. On the occasion of our visit there was cold, damp weather, and the engine was quite cold. It started up, nevertheless, in about 30 seconds.

A peculiarity of the locomotive is the arrangement of the radiator. There is only one, regardless of the fact that the engine may have to run in either direction. This radiator, as will be seen from the drawing, is in the orthodox position, but the draught through it is reversed. There is a fan, driven directly by the engine, which sucks out of the cab, and thus keeps the air there fresh, and drives it outward through the radiator. In front of the radiator there is a shield, which checks a direct, counteracting draught from the movement of the locomotive, and the cooling air is discharged through side openings. The radiator itself is noteworthy on account of the fact that the tube plates are attached to the headers by means of rubber diaphragms, so that the tube joints are not subject to vibration. The tubes are of the normal gilled type.

The clutch through which the drive is transmitted to the gear-box is of the multi-plate type, and is very "sweet" in operation—a characteristic which we tested by having the locomotive run up to couple with a light platelayers' trolley. The coupling was effected, quite readily, without moving the trolley. The clutch is actuated by compressed air, taken off the Westinghouse braking system, and is controlled by a foot pedal. The pedal operates a reducing valve, and there is a non-return valve, with an air leak, fitted between the reducing valve and the pressure diaphragms, which provides a delay action on the re-engagement of the clutch, so that the sudden release of the clutch pedal does not affect the gradual engagement of the clutch when taking up the drive. From the clutch the drive is transmitted to the gear-box by a short shaft fitted with flexible couplings of the Simms-Jurid type at both ends.

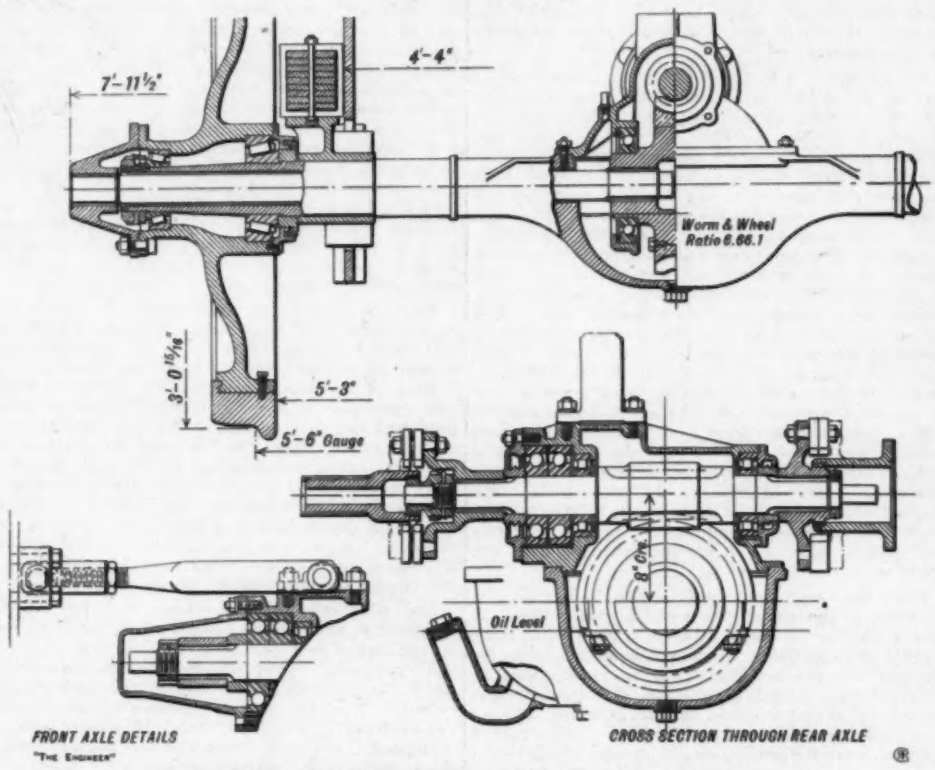
The gear-box, which presents many interesting features, was designed in collaboration with David Brown and Sons, Ltd., of Huddersfield, and was built at that company's works. It provides four speeds in either direction, the various speeds being 5, 10, 15 and 20 miles per hour in either direction with the engine turning at 800 r.p.m. Force-feed lubrication is fitted to all the bearings, and oil

jets are arranged to force oil to the gears at the points of engagement. Considerable attention has been paid to making the gear-box as foolproof as possible, and to that end locking arrangements are provided, so that it is impossible to attempt to engage or change any gear in either direction without first releasing the clutch. In addition, a further lock is provided to prevent the reverse lever being engaged until the locomotive is stationary. These interlocks are effected by means of fingers, which engage with the teeth of a quadrant that is attached to the change-shaft of the gear-box. They, to a large extent, prevent damage to the gear-box, but do not assist or reduce the skill required to change gear on the normal type gear-box. On the Wickham locomotive, however, it is possible to change from any gear to another, up or down, and it was demonstrated to us at the works that when the locomotive is running in top gear, bottom gear can be immediately engaged without noise or shock by merely releasing the clutch and putting the gear lever into the desired position—the throttle not being touched in any way. The motor took up the drive automatically as the engine and locomotive speeds coincided.

The gear-box is a straightforward, simple mechanical job, and does not incorporate any hydraulic, electric or friction clutches, all the gears being of the constant-mesh type, while the changes of speed are made by simple dog clutches of sturdy design.

From the gear-box the drive is taken by means of a short shaft fitted with Simms-Jurid couplings and centring devices to the rear axle worm casing. The worm shaft of this axle is extended to allow a further shaft to transmit the drive to the front axle, which is identical and interchangeable with the rear.

The axles themselves, of which we give a drawing, are



AXLE CASING AND WORM DRIVE OF 100 H.P. OIL LOCOMOTIVE

of the full-floating type with forged steel casings, similar to those fitted to heavy road vehicles, but modified for railway work and fitted to hornplates with renewable rubbing plates. With this type of axle the weight of the locomotive is taken on the stationary forged steel axle casings, the driving shafts being relieved of all but torque loads. The wheels, which have cast steel centres fitted with rolled steel tires, are 3ft. 1in. in diameter, and are mounted on large diameter Timken roller bearings. With this construction the driving shafts, worm and worm wheels can be removed, if necessary, without taking off the wheels.

Both hand and power brakes are provided, the latter being of the Westinghouse compressed air type. Compressed air sanders, sanding all wheels in both directions, are also fitted. A further use for compressed air is to operate the whistle, the necessary air being provided by a Hamworthy compressor belt driven from the main engine.

Full electric light equipment, controlled from the driver's position, is also provided. The equipment includes electric head and rear lamps, interior lights and portable inspection leads. Standard buffing gear is fitted, but this, we understand, can be varied to meet requirements.

The frame, which is of the plate type, is of very substantial constructon, both main and sub-frames being of ¾ plate, while the buffer beams are of 1in. material, reinforced with deep angle gussets.

The leading dimensions of the engine are as follows :—

Gauge	5ft. 6in.
Length over buffers	20ft. 6in.
Width	10ft. 2in.
Height	12ft. 6in.
Weight in running order	18½ tons
Weight on front axle	9½ tons
Weight on rear axle	9½ tons
Draw-bar pull, 5 miles per hour	6500 lb.

The controls, which consist of a foot clutch pedal, hand throttle, power brake, gear lever and reverse lever, are handily arranged, so that the driver can operate them while looking out of the side windows. The throttle, power brake, clutch and reverse lever are duplicated on either side of the cab, so that the locomotive can be controlled from either position.

South African Engineering Notes.

New Gold Recovery Process.

ACCORDING to Mr. J. R. Williams, M.I.M.M., and once President of the Chemical and Metallurgical Society of South Africa, a process discovered by Dr. Annable, chemical and metallurgical expert to Alloys, Ltd., Port Elizabeth, has succeeded in extracting gold from refractory ores, and particularly the ores of the same type as those of the Murchison Range in the Transvaal. With Dr. Annable's new process a recovery of 90 per cent. of the gold was obtained, and Mr. Williams believes if the calcination process is continued somewhat longer than at present that percentage may be increased to 95. The antimony is also recovered as well as the mercury used. The great feature of the process appears to be the calcination, in which some by-product, which it is stated is to be had cheaply in South Africa and in any quantities, is used, but the nature of this has not yet been disclosed. The fact that Mr. Williams and a number of well-known mining engineers, chemists and metallurgists who saw the trial charges worked through are so satisfied that they recommend operations on a large scale, would indicate that in their opinion Dr. Annable has justified his assertions. If the process does what is claimed for it, it will at once set free £100,000,000 worth of gold, which on a low estimate is at present locked up in the antimonial ores of the Murchison Range in the Transvaal. In this range values to as high as 2 oz. and 3 oz. per ton are common, but hitherto, in spite of a number of years' experimenting, it has been impossible to separate it from the antimony at a profit. Great quantities of ore in other parts of the Union as well as in Rhodesia, Canada, and elsewhere will also be amenable to the process, so that the possibilities are widespread.

Table Bay Docks.

During the last few months considerable headway has been made with the reconstruction work in Table Bay Docks. Although there is still much to be done before the new basin is completed, it is anticipated that the first ocean-going vessel will be berthed at No. 1 South Wall during this year. This work has meant employment for at least 500 men. The new South Arm, when complete, will be one of the most efficiently equipped quays in the world. In addition to an unbroken line of double-storey cargo sheds of the most up-to-date pattern, it will have nineteen 4-ton cranes, which should be sufficient to cope with any unexpected rush of ocean-going traffic that may arise. It is estimated that for the equipment of the South Wall, South Arm, and South Arm Return Head, about 15,000 lineal yards of railway track will be required to be laid. To date about 700 yards have been laid and are in service.

New Tramcars.

The management of the local tramway company at Port Elizabeth is displaying great faith in the future development of the city, and it has taken the practical form of placing an order for eight of the latest type motor omnibus chassis with the Albion Motor Company, of Glasgow. The chassis are of that firm's "P.M.A." 28 type, to carry 32 passengers. The engines are of the four-cylinder type and 30 to 60 H.P. The wheel base is 16ft. 3in. There are single wheels in front and twin wheels in the rear, all fitted with 38in. by 7in. tires. There are brakes on all the wheels, the service brakes being controlled by Dewandre servo gear, and the emergency brake by a susbtantial lever in the usual manner. The bodies are being built by the tramway company in its works at Valley-road, thus providing needed employment. Delivery is being urged forward as much as possible. There is no doubt that the fleet of omnibuses will be a welcome addition to the city's transport services. The company is also showing its faith in trams by adding to its fleet from time to time. Numbers of new large, single-deck trams have been built during the last year or two in its own workshops, as well as a number of new bodies built for existing chassis. The latest additions are two new trams which were recently put into commission. The seating capacity of these vehicles is 58 people. It is noteworthy that the mild steel frames were made to the company's design and pattern by the Dunswart Iron and Steel Works, which succeeded in turning out a very sound job.

New Research Vessel.

The South African research vessel "Africana" arrived from Aberdeen at the end of December on her maiden voyage out. Commander Shannon and a local crew will be engaged. Commander Shannon was formerly captain of the Falkland Islands research vessel "William Scoresby," and for over two years was engaged in whaling research among the numerous islands south of the Falklands and along the ice barrier. The "Africana" is 125½ft. long and 25ft. beam and is one of the finest vessels of her type ever constructed. She was built by Messrs. Hall, Russell and Co., of Aberdeen. An outstanding feature of the ship is a large and fully equipped laboratory, in which the scientists can work in comfort. The chart room contains a Marconi wireless installation, Hughes echo-sounding gear with recorder, and Graham's telephones to various parts of the ship. There is also a refrigerating chamber to preserve stores in warm weather. Two searchlights are fitted on the bridge, and on the fore deck there is a direct-acting trawl winch, which is capable of holding 1000 fathoms of 1½in. wire on each barrel. On the fore deck is a Lucas sounding machine with 5000 fathoms of piano wire and a wire reel with 2500 fathoms of plankton wire. The propelling machinery consists of high-powered triple-expansion engines, which will give the vessel a speed of 12 knots. The engines have several special features, including a large condenser for working in warm waters. A comprehensive set of auxiliary machinery is fitted in the engine-room, all the pumps being spearate units, none being worked from the main engines.

New Municipal Undertakings.

The Municipality of Paarl (Cape) has decided to raise a loan of £70,000 for the erection of its own power station. The Municipality of Durban has budgetted for a capital expenditure of £129,000 during 1931 upon its electrical requirements, of which cables for pressures from 33,000 to 200 volts account for £48,613; overhead mains extension, £29,300; and sub-stations, switchgear, and transformers, £26,420. The estimates of capital expenditure on the Cape Town electricity undertaking for 1931 amount to £198,000, and are principally for extensions of the transmission and distribution systems. Of this sum approximately £86,000 represents the cost of erecting or completing the erection of twenty-eight sub-stations and equipping or completing the equipment of forty-eight sub-stations. The representatives of the Town Councils of Germiston, Boksbury and Benoni (Transvaal) are still discussing the proposed joint sewerage scheme for the three towns, which, it is estimated, would cost about £750,000. The Somerset Strand Council is considering plans for a water-borne sewage system for the town at an estimated cost of £100,000. Gwelo (Rhodesia) is raising a loan of £55,000 to augment the town's water supply. Durban is to spend £77,527, chiefly on water mains extensions and service reservoirs, in 1931.

Huge Electric Furnace.

On January 15th the Rand Carbide, Ltd., switched in a further large electric carbide furnace to cope with the increasing demands for its product. The new furnace is the largest in the Southern Hemisphere, and one of the largest in the world. To operate it, electrical energy equivalent to 7200 horse-power is required, and the output will be 1000 tons of carbide per month. Electric power is supplied by underground cable from the Electricity Supply Commission's super-power station at Witbank at 21,000 volts.

State Steel Finance.

The public has not yet been invited by the Board of the South African Iron and Steel Industrial Corporation, Ltd., to subscribe for shares in this company. It was generally understood when the company was originally registered that the Government would endeavour to secure part of the capital by public subscription. Work on the site was started nearly a year ago, and the failure of the Board to ask for public applications for shares is causing some concern. The actual work on the site is making considerable progress. The company has received up to date £500,000 from the Government as part of the State contribution to the enterprise, and it is learnt that the Government is making provision on the Estimates for 1931–32 for a further contribution which is expected to exceed £1,000,000. Apparently all this money will be required during the year, and there are indications that the £500,000 provided are now exhausted. The fear is generally entertained that the Government will eventually be called upon to foot the whole of the bill, as it has got about that the Board has no intention to ask for public subscriptions at the present, and that the appeal to the public may be delayed until the works reach producing capacity. The chairman of the board has just announced that the corporation will forthwith call for tenders for the construction of the foundations of the steel works. This will include also the construction of emplacements for the machinery and blast-furnaces and the construction of several very high brick chimneys. Mr. Ernst Kerl, the German steel expert, who has been appointed to take charge of the smelting and rolling mills departments, and who will probably qualify to become general works manager, is now—January 23rd—on his way out to South Africa, and will therefore be here to assist in the establishment of the works.

Institution of Mechanical Engineers.

HIGH-PRESSURE LOCOMOTIVES.

THE discussion on Mr. Gresley's paper on "High-pressure Locomotives," which was presented before the Institution of Mechanical Engineers on January 23rd, was resumed last Friday, February 6th. Opening the proceedings, the President, Mr. Pendred, suggested that some attention might be paid to the earlier portions of Mr. Gresley's paper and that speakers should not confine themselves exclusively to a discussion of the merits of the L.N.E.R. high-pressure engine. Efficiency, he said, was useless unless it were accompanied by economy. If a high-pressure locomotive cost £1000 more to build than a normal locomotive of the same capacity, then it would have to pay off that debt by virtue of its increased efficiency before it could show any economy. If, in addition to costing more, it was more expensive to maintain in running condition, then its chances of showing an economy were much more remote. Those facts were at the root of all good designs of new locomotives. He therefore held that it would be desirable if those taking part in the discussion would deal less with the details of the individual designs of locomotive described by Mr. Gresley and more with the general question of the relative advantages of normal and high-pressure engines.

Colonel Stenning, opening the discussion, devoted his remarks in accordance with the President's suggestion mainly to the economy of the high-pressure locomotive. He had to admit, however, that as yet no high-pressure locomotive had been in service for a length of time sufficient to enable definite conclusions to be drawn on the subject. He argued that the fire-box and its maintenance were the main features entering into the question of economy. The copper fire-box of the ordinary locomotive was one of its most expensive items to provide and to maintain in working condition. The designers of the engines described in Mr. Gresley's paper had replaced the copper fire-box with one composed of steel tubes. By so doing they had adopted a system of which the merits and demerits were as yet not fully known. After three years of more or less continuous service the Schmidt-Henschel engine showed no deterioration in the water tubes forming the walls of the fire-box. Some of the tubes had been out out for examination. They had been found to be as good as when they were put in and to show no visible external or internal damage. On the other hand, in the Schmidt multi-pressure engine on the L.M.S. Railway some trouble had been caused by the high temperature and high pressure to which the tubes were subjected. The question of material was all important. Special materials of an expensive kind had to be employed in the fire-boxes of high-pressure engines, and there were many other factors which made the construction costly. The question, therefore, was whether those extra costs could be compensated for by the absence of the high charges incurred in the provision and maintenance of the normal type of copper fire-box.

Continuing, Colonel Stenning touched briefly on the merits of two *versus* three and four cylinders for high-pressure locomotives and upon the most desirable pressure to adopt. Should the pressure be 450 lb., 600 lb., or 800 lb.? He suggested that the best would probably be found to be some mean value between those figures, but what precisely it was likely to be he could not say. Passing to a discussion of the detailed design of engine "No. 10,000," he drew attention to the fact that the fire-door was of the automatic type. It was very important that it should be so in a high-pressure locomotive, because of the danger which would arise if a tube burst when the fire-door was open. In the Schmidt-Henschel engine, it was interesting to note, not more than 120 gallons of water would be discharged if a fire-box tube burst. He asked whether Mr. Gresley had found any increased rate of deterioration in the fire-bars of his engine consequent upon the admission of hot instead of cold air through them. If the deterioration were excessive he would suggest that the fire-bars should be treated with aluminium by the aluminising process. In most designs of high-pressure engines the main drum was protected from the direct heat of the fire. In Mr. Gresley's engine it was not protected. Its lower portion was exposed directly to the fire and, in addition, the metal of the drum over the lower half was thickened up to accommodate the tubes which were expanded into it. He was afraid that in those circumstances the drum would be liable to become overheated. The position and design of the brick arch would, he held, intensify the heating effect on the drum, for the arch would produce a blow-pipe action which would be particularly severe round its lip. Concluding, he said that the locomotive experiments now being carried out in this country were most commendable and exceeded in variety and number those being conducted by any other nation. We had the Schmidt multi-pressure engine on the L.M.S., Mr. Gresley's engine on the L.N.E.R., and the pulverised fuel experiments on the Southern Railway. As a locomotive man he held that the steam locomotive was going to beat all the efforts of the oil engine and electrical people to displace it, and would definitely establish itself as the cheapest and best vehicle of haulage on the railways.

Herr Gysel, of the Winterthur Works, said that his company's high-pressure locomotive was a small engine developing about 800 H.P. at the draw-bar. It had been built at the firm's own risk, for in Switzerland, with about 80 per cent. of the railway traffic handled electrically, there was little opening for improved steam locomotives. The steam and coal consumption of the Winterthur engine had been carefully measured. It had been coupled to a dynamometer car, followed by one or two coaches and then by an engine which was used to brake the speed of the train. The throttle valve of the high-pressure engine was opened and the cut-off set and neither was again touched during the tests, the different speeds being obtained by varying the braking effect applied by the second engine. The results of the tests showed that without any doubt a coal consumption as low as 2¼–2½ lb. per draw-bar horse-power per hour could be obtained. The best recorded figure over an hour's run was 1·9 lb. Describing Mr. Gresley's engine as a 4-6-4 arrangement, he said that that type might be criticised on the ground that it became short of adhesion at high speeds. When the engine was travelling rapidly the load became unduly heavy on the leading and trailing groups of axles and the coupled wheels lost part of their load. He argued, therefore, that the "Pacific" type of wheel arrangement would be superior. In the most intensely heated fire-box tubes of the Winterthur engine a hard thin layer of scale had been found after 25,000 miles of service. Whether that layer constituted a source of danger had been the subject of prolonged discussion. He would like to have Mr. Gresley's views on the subject.

Mr. Marriner, of Messrs. Yarrow, said that his firm had learned a very great deal from being associated with Mr. Gresley in the design and construction of the boiler of "No. 10,000." They had all been impressed particularly with the skill that was necessary in designing a modern locomotive in order that the powerful machine required might be accommodated within the limited space and weight available. Some years ago Messrs. Yarrow had been consulted by the American Locomotive Company in connection with the design of a water-tube locomotive boiler, but in that case the loading gauge and the limitations of weight were much greater than had to be met in this country. In the American engine to which he was referring, the boiler, as would be seen from the description of it given in Mr. Gresley's paper, did not go all the way to being a water-tube boiler. The experience gained since that time showed that if full advantage were to be taken of high pressures it was necessary to adopt the all-water-tube boiler. The problem presented in the design of the boiler for "No. 10,000" would have been quite simple had an extra head room of 1ft. been available. As it was, it was only made soluble by Mr. Gresley's bold step of placing the trailing bogie beneath the fire-box.

From the very start of the design the question of hardness in the water had been in their minds. A choice had to be made between considerable complexity or simplicity combined with facilities for cleaning the tubes. There was no doubt that in selecting the second alternative Mr. Gresley had chosen the correct solution. While, however, reliance was placed on facilities for cleaning the tubes rather than on means for preventing all deposits within them, the feed water was not introduced into the boiler in a haphazard manner. The water was admitted into a part of the steam drum which contained no tubes, and which was separated from the rest of the boiler by a weir. In addition, the feed was introduced through a Gresley injector in which the water passed through a nozzle and sucked in steam, as contrasted with an ordinary injector in which steam passing through a nozzle sucked in water. The Gresley injector heated the feed water practically up to the boiler temperature. The temporary hardness constituents were deposited in the space in front of the weir. The permanent hardness constituents could not be dealt with otherwise than by allowing them to deposit themselves and by removing them at intervals. It was regrettable that in these days of chemical advancement no better method of dealing with permanent hardness could be adopted. As regarded the question of circulation, the appearance of the tubes showed that it was ample. With our present knowledge concerning circulation, one was tempted to wonder what used to happen in the large locomotive type boilers fitted in early destroyers with their narrow water spaces and a forest of stays hindering free circulation in every direction. Yet, in spite of their faulty circulation, those boilers would be fired with 90 lb. of the very best Welsh coal per square foot of grate area. Concerning the future, he said that there would not be the slightest difficulty in making a boiler similar to that of "No. 10,000" for any pressure that might be required. The system of air heating adopted in the Yarrow-Gresley boiler was so efficient that the loss from radiation was very small and was practically independent of the temperature of the boiler itself. It was probable that the next step would be the adoption of mechanical means for firing the boilers of very large locomotives, but for the present one man, so far as the engines used in this country were concerned, was quite able to perform the work.

Dealing with Colonel Stenning's remarks concerning the exposure of the steam drum to the direct heat of the fire, Mr. Marriner said that following the usual Yarrow practice, the metal of the drum was thinned down between the banks of tubes in order that the transmission of heat should not be impeded. He did not anticipate any trouble from overheating.*

Mr. Charles King, discussing the design of the Loeffler engine, said that whether it would show, as it was claimed it would, an overall thermal efficiency of 18 per cent., remained to be proved. That figure might, however, be compared with the efficiencies of 29 per cent. and 32 per cent. obtained in the Soviet Government's Diesel-electric and Diesel-geared types of locomotive respectively, and with the efficiency of about 25 per cent. reported as having been reached by the Diesel-compressed air engine on the German railways. Mr. Gresley had stated that as originally designed the boiler of his engine had given steam superheated to 900 deg. Fah., and that he had introduced modifications in order to lower the temperature to 700 deg. On the Continent a temperature of 700 deg. was regarded as very little above the normal in locomotive boilers of the ordinary type and working at ordinary pressures. In the Loeffler high-pressure engine the temperature of the steam was 900 deg. Fah. Why had Mr. Gresley considered 900 deg. too high? Was it on account of difficulties connected with the lubricating oil, the stuffing-boxes, or creep in the metal? The particulars given in the paper of the Delaware and Hudson engines and of the Schmidt multi-pressure engines, together with the data presented regarding Mr. Gresley's engine, provided much food for reflection. The coefficient of adhesion in the Delaware and Hudson engines was in accordance with American practice, very high, being about 1 : 3. That figure would apply only when starting or at low speeds, but as the engines were apparently of the "Consolidation" class, their speed would very often be low. Mr. Gresley gave the coefficient of adhesion for his engine as 1 : 4·37, but it was to be supposed that at ordinary running speeds it would on the average be about 1 : 6, and that the cylinders had been proportioned to give the greatest economy of steam with a tractive effort corresponding to that average coefficient.

Next, it would be noted from the particulars in the paper that in the three successive Delaware and Hudson engines the ratio of the heating surface to the superheater surface had been reduced from 5·5 to 4·4, and finally to 3·25 to 1. It would, therefore, seem that at first the expected degree of superheat had not been realised. Yet, in Mr. Gresley's engine, the superheat, at first, had been held to be too great. The superheating surface had, therefore, been reduced to 140 square feet, corresponding to a ratio of 1 : 14. That ratio was very low. On the Continent, for engines of normal type, the ratio was about 1 : 3 to 1 : 4 on the average. It was difficult to understand why the small superheater surface in Mr. Gresley's boiler sufficed for its purpose.

The proportions of the high and low-pressure cylinders in the various designs of engine dealt with in the paper had particularly interested him. In the "Schmidt" type, with boiler pressures between 850 lb. and 900 lb., the ratio of the high-pressure cylinder volume to the low-pressure cylinder volume varied from 1 : 4·6 to 1 : 6·2. It was difficult to understand why there should be any such variation, since, presumably, all the engines were constructed in consultation with the Schmidt Company. In Mr. Gresley's engine the ratio was originally 1 : 2·8, but it was altered by the reduction in the diameter of the high-pressure cylinders to 1 : 4. In the Delaware and Hudson engines the ratio had been preserved in all three examples at 1 : 3. The tractive effort of a compound locomotive was, *ceteris paribus*, dependent on the size of the low-pressure cylinders. By varying the size of the high-pressure cylinders and the cut-off in them, the division of the total power between the high-pressure and low-pressure cylinders could be adjusted. It was, therefore, important to compare the coefficient of boiler pressure referred to the diameter of the low-pressure cylinders of each type. For a uniform coefficient of adhesion of 1 : 6, the coefficient C of boiler pressure in the formula for the tractive effort $T = C\,p\,d^2l/D$, was found to be 0·39 in the L.N.E.R. engine, 0·286 in the "Horatio Allen," 0·296 in the "J. B. Jervis," and 0·285 in the "James Archibald." Taking the actual coefficients of adhesion given in the paper, the pressure coefficients for the same four engines were, respectively, 0·53, 0·46, 0·47, 0·46. French engineers, who had had great experience in building and running compound locomotives, used a cylinder ratio of 1 : 2·3 to 1 : 2·7, according to the boiler pressure, and a pressure coefficient C of 0·38 to 0·45, calculated on an adhesion coefficient of 1 : 6. Those figures, he stated, were good for steam pressures between 185 lb. and 230 lb. With higher boiler pressures, such as 350 lb. to 500 lb., the high-pressure cylinders would, naturally, have to be decreased in size—that was to say, that the cylinder volume ratio should be less than 1 : 2·3 or 1 : 2·7, and, in addition, the

* In the cross section of the boiler contained in the paper as circulated at the meeting the drum shell is shown as being of equal thickness over the whole of its lower portion. The thinning down referred to by Mr. Marriner is clearly shown in the cross sections which we reproduced on page 164 of our last issue.—ED. THE E.

pressure coefficient C should also be smaller. He concluded, therefore, that in the L.N.E.R. engine, larger low-pressure cylinders would have been desirable, but, perhaps, the loading gauge prevented any increase. He concluded, also, that in the Delaware and Hudson engines, the low-pressure cylinders were too large.

Passing to the question of cut-off in the cylinders, Mr. King remarked that he had understood Mr. Gresley to have said that in normal working the cut-off in the high-pressure cylinders was at 50 per cent., and in the low-pressure cylinders at 25 per cen. On the Continent it was the practice to make the cut-off in the low-pressure cylinders later than in the high-pressure cylinders, and to make the difference in the two cut-offs greater as the speed became greater. For example, at 60 m.p.h. the cut-off would be 35 per cent. high-pressure and 55–65 per cent. low-pressure. At lower speeds they would be made about 60 per cent. high-pressure and 75 per cent. low-pressure. In that way, at high speeds, the main portion of the work was done in the high-pressure cylinders. On a bank, or accelerating, the power would be equally divided between the high-pressure and low-pressure cylinders. For many years the P.L.M. Railway had adopted a constant cut-off of 65 per cent. in the low-pressure cylinders, and varied the cut-off only in the high-pressure cylinders. The engines had done very good work. When the Prussian Railways, some years ago, tried four-cylinder compound engines, it was decided to make the relative cut-off invariable. The engines were not perpetuated for they were found to be sluggish. He suggested that one of the reasons why the three-cylinder 4–4–0 compound engines of the former Midland Railway had been successful was because the proportioning of the high-pressure and low-pressure cut-off was variable.

Mr. P. J. Cowan remarked that the fact that the Delaware and Hudson Railway had built a third high-pressure engine appeared to indicate that that railway was satisfied with the design which it had adopted. In 1927, however, he had heard that it had been decided to give up the type. What, he asked, was the true position? There were, he observed, no stays in the boiler of "No. 10,000." That was an advantage which the Delaware and Hudson engines could not claim. In the first of the American high-pressure engines, there had been no trouble at the stays, but there had been leaks from the seams. Flexible stays were subsequently adopted—they were not shown in the drawing of the "Horatio Allen" boiler reproduced in the paper—and the trouble was cured. He did not, however, wish to suggest that the Delaware and Hudson type of boiler would prove satisfactory at increased pressures. Commenting on Mr. Gresley's reference to the boiler as a structural feature of his engine, he said that the illustrations in the paper did not make the arrangement quite clear, and he suggested that additional illustrations should be given. The framing also presented many novel and remarkable features, the trailing end being of particular interest. Commenting upon Mr. King's reference to the fact that the superheater surface in the American engines had been progressively increased with each engine, he said that a possible reason why the earlier engines did not give the superheat expected of them was that a new type of spiral tube superheater had been used concerning the performance of which information was lacking. A shot had to be made in the dark and the deficiency corrected by the results of experience. Referring to Herr Gysel's remarks concerning wheel arrangement, he called attention to the fact that Mr. Gresley nowhere described his engine as being of the 4–6–4 type. Since the two trailing axles were independent, he thought that it would be correct to speak of it as a 4–6–2–2 engine. All things considered, he thought that pressures of from 400 lb. to 600 lb. might be expected to be those best suited for high-pressure locomotives. It would be interesting to see the development of a high-pressure turbine condensing locomotive, but he thought that such a machine would prove economically unsound. As a railway shareholder, he was glad that Mr. Gresley was working along the lines represented in engine "No. 10,000."

Major Gregson showed slides illustrating a small locomotive, the "Siemens," which, he said, was the only engine ever constructed in this country with a Broton fire-box. That fire-box had a single row of tubes on each side, a fact which, Major Gregson said, made circulation difficult or impossible. The engine, he remarked, would not work until circulation was permitted by fitting an external pipe connecting the bottom of the barrel portion of the boiler with the lower header to which the fire-box tubes were connected. The fire-box of "No. 10,000," he argued, with only four rows of tubes in each wall, seemed to offer very little chance of a good circulation, because of the small temperature gradient between the inner and outer tubes. The principles governing large tube boiler design seemed, in fact, to have been mixed up with the principles governing small tube boiler design. Passing to the question of the feed water, he referred to the Druitt Halpin thermal storage system, and to some crude, but effective, attempts, which had been made in France during the war to apply its principle in locomotives which had to run on very impure water. Such arrangements, he said, would deal with the temporary hardness, but not with the permanent hardness. The London and North-Eastern Railway ran through a long belt of magnesium limestone, the water of which contained the constituents responsible for permanent hardness. Were any steps, he asked, taken to soften the water before it was admitted to the boilers of engines operating in the region to which he was referring? Looking back over the history of the steam locomotive, one was forced to the conclusion that whereas during the past hundred years railway engines had evolved in their details and increased greatly in their size and power, they were, in principle, still identical with the "Rocket." He wondered whether in days to come Mr. Gresley's engine would not be seen to be the first real departure from the traditions established by Stephenson. The steam turbine condensing locomotive might yet play an important part in railway history. The examples of it built and tried in this country had not been successful, primarily because they were too heavy on the road. He believed, however, that the resources placed at the disposal of engineers by metallurgical research might still enable those locomotives to be successfully redesigned.

Mr. Diamond said that engine "No. 10,000" had been designed, not with the object of producing a spectacular test figure, but to bring a real commercial gain to the railway operating department. In that connection it was surprising that the author had not mentioned the Baldwin compound locomotive described before the Institution by Mr. Lawford Fry in 1927. That engine had a boiler pressure of 350 lb., and, like Mr. Gresley's, was a sound practical development, and not merely a freak experiment. The author had said in the early part of his paper that locomotive designers in striving for economy by the use of increased pressures were only following the lead set by designers of large stationary plants and by marine engineers. That remark was perhaps too literally true. High pressures had become fashionable, and the locomotive engineer had felt that he must be in the fashion. Hence, there were undertaken tentative and risky experiments with enormously high pressures. Yet all the time more than half the railway companies' standard locomotives offered a possibility of achieving a comparable economy by leaving the boiler pressure as it was and by redesigning the valve gear with the object of reducing the back pressure by 5 lb. or 10 lb. per square inch.

The theoretical utmost gain obtainable in a locomotive by increasing its pressure from 250 lb. to 450 lb. was about 20 per cent., assuming the same superheat temperature and a back pressure of 17 lb. absolute. Only a minority of locomotives, however, exhausted against a back pressure of 17 lb. at normal running speed. In most cases an exhaust pressure of 25 lb. absolute was nearer the figure realised. The reduction of that pressure by 8 lb. offered a gain of over 10 per cent. in the efficiency or fully half the gain obtainable by an increase of 200 lb. in the boiler pressure. Again, a locomotive seldom ran with its regulator fully open. What, then, was the use of maintaining a boiler pressure of even 200 lb. if the steam in the cylinder never exceeded about 150 lb.? Much of the work done by a locomotive called for a mere fraction of its total power capacity. That fact would considerably reduce the saving of coal which could be expected from the adoption of high pressures. The coal consumption of standard passenger locomotives had been reduced from over 4 lb. per draw bar horse-power hour to 3 lb., simply by equipping them with modern long-travel piston valves or poppet valves. The further reduction claimed to be made by the use of very high pressures was only to 2½ lb. So long as there were still many engines in service using 4 lb., it was obvious which should be the first method to be adopted for reducing the country's total locomotive coal bill of £12,000,000 per year.

The question of the lower limit of pressure became increasingly acute as the upper limit was raised. In order to maintain the same back pressure, a locomotive with a boiler pressure of 450 lb. had to expand the steam to six times its original volume, as compared with 3½ times in a locomotive with a boiler pressure of 250 lb. Hence, unless careful attention were given to the design of the valve gear and cylinder ports in the high-pressure engine, most of the gain of efficiency resulting from adding 200 lb. to the upper limit would be lost by the increase of a few pounds in the back pressure. Recent cases were known in which difficulty had been experienced in securing adequate expansion, even in 250 lb. locomotives, and in which the coal consumption had been *improved* by reducing the steam pressure at the regulating valve.

Turning to the question of superheat, Mr. Diamond asked whether it were sufficient that steam at 450 lb. should be superheated to about the same temperature as steam at 250 lb., or were locomotive engineers, like stationary plant designers, soon to hanker after temperatures of 1000 deg. Fah.? The author had said that a temperature of about 700 deg. was sufficient, and he hoped that Mr. Gresley would not allow himself to be shaken in that belief, at any rate until he contemplated adding a condenser to his equipment. It was, of course, true that with an increase of pressure an increase of temperature was necessary, in order to maintain the same dryness fraction in the steam at exhaust. But no one was certain that in a modern superheater engine running at normal speed, the steam had any moisture at all in it at the end of expansion. An investigation which he had made† suggested that at high speed the degree of superheat was so much increased by throttling at admission that at the moment of release from the cylinder the steam was still above the saturation point. If that were so, it was futile to enter the hazardous region of high steam temperatures, so long as the steam locomotive remained of necessity a rough-and-ready affair in comparison with power generating steam plant.

Lieut.-Colonel A. E. Davidson was prevented from speaking because of the necessity for allowing Mr. Gresley ample time in which to reply to the discussion. Colonel Davidson informs us that he had intended to ask what, if any, steps were taken to purify the water at the various points at which "No. 10,000" picked it up. He is satisfied that such treatment would hold the promise of considerable economy as regards repairs. He had also desired to refer to the fact that in some countries possessing less abundant supplies of water than we did, economy of water consumption might be of more importance than economy of coal. In such countries a high-pressure boiler and an efficient engine effecting a considerable saving of steam might, Colonel Davidson thinks, have a greater future before it than it has in this country and other temperate lands. He hopes therefore that when the information in Mr. Gresley's paper is supplemented by particulars of the results obtained in service, water consumptions as well as fuel consumptions will be given. In conclusion, Colonel Davidson had intended to refer to the development of condensing engines as alternatives to the employment of compression-ignition locomotives, on lines passing through arid districts, such as the Sahara.

Mr. Gresley began his reply to the discussion by saying that he looked forward with pleasure to giving at a later date further particulars concerning engine "No. 10,000" and its performance. He described that engine as a "freak," but, unlike other freak locomotives which had been built, it had not retired from service within a few weeks, but was still running satisfactorily more than a year after its first trial. Questions had been asked by Sir Henry Fowler and others concerning the method employed for cleaning out the fire-box tubes. A "Skatoskalo" cleaner had been used, but as originally supplied it was found that while it cleared the outer walls of the curved tubes of scale, it did not remove the scale on the inner walls. A universal joint was added to the device and when so fitted it performed its work successfully. The only tubes to which attention had to be paid were those next the fire. Scale did not form in the others. Difficulty was experienced in examining the inside of the tubes to see if the scale had been completely removed. That difficulty was overcome by means of an appliance devised by a member of his staff at Darlington. The instrument, demonstrated at the meeting, consisted of an electric lamp in circuit with a four-point contact device, which could be inserted in any tube and pushed through it. If any one of the four points was kept out of contact with the metal walls of the tube by the presence of scale, the scale acted as an insulator, and the lamp would not light up. Dealing with the question of circulation in the fire-box tubes of the L.N.E.R. engine, he argued that such circulation was not altogether produced by virtue of a temperature gradient across the rows of tubes. There was violent ebullition in the tubes next the fire, which carried the water upwards after the manner prevailing in an air lift. The outer rows of tubes were not exposed to radiation from the fire, and therefore there was less or no ebullition in them. He was satisfied in his own mind that the circulation was upwards in the inner tubes and downwards in the outer. In the Broton fire-box with its single row of tubes, there could be no circulation until the external pipe, referred to by Major Gregson, had been added. In "No. 10,000" the cylinder volume ratio as originally planned was about 1 : 3. It had been altered to 1 : 4. Mr. King had stated that in French compound practice the ratio adopted was 1 : 2·3 to 1 : 2·7. Those ratios were probably the best that could be adopted for pressures of about 250 lb., but a pressure of 450 lb. was very different. As Mr. Diamond had pointed out, to obtain the same back pressure steam at 450 lb. had to be expanded to six times its original volume, as compared with 3½ times for steam at 250 lb. The 1 : 4 ratio finally adopted in "No. 10,000" was, he maintained, in agreement with Mr. Diamond's argument. A 1 : 4 ratio at six expansions was fairly consistent with a 1 : 2·3 ratio at 3½ expansions. He had aimed at doing more work in the low-pressure than in the high-pressure cylinders, and at normal speed a third of the work was actually done in the high-pressure cylinders. He confirmed the statement that at normal speed the cut-off in the high-pressure cylinders was at 50 per cent., and in the low-pressure cylinders at 25 per cent. An early cut-off in the low-pressure cylinders reduced the back pressure. He could not follow the argument in favour of increasing the cut-off in the low-pressure cylinders, for the effect of such an increase would be to send up the pressure of the blast.

Dealing with the wheel arrangement at the trailing end of "No. 10,000," Mr. Gresley said that the

† THE ENGINEER, November 22nd, 1929.

trailing axle constituted a Bissel truck. The arrangement adopted was rendered necessary because there was no room beneath the fire-box for a top bogie centre. The engine was very easy in its riding; more so than it would have been if the two trailing axles had constituted a bogie, for in that case the wheel arrangement would have been symmetrical, and a swaying couple would have been set up. As to the method of describing the engine, he preferred to speak of it as a 4–6–4 rather than a 4–6–2–2, as suggested by Mr. Cowan. The second-named nomenclature would imply, to his mind, that the engine consisted of a four-wheeled bogie, six coupled wheels, an axle with a booster, and a carrying axle.

There was no tendency to overheating of the steam drum where it was exposed to the fire. As mentioned by Mr. Marriner, the thinning down of the drum wall between the two banks of tubes had avoided trouble on that score. He had to thank Messrs. Yarrow, Mr. Marriner, and the staff generally for their assistance and co-operation throughout the designing and constructing stages. In the early days they had not always seen eye to eye. For example, Messrs. Yarrow had been inclined to favour small tubes for the fire-box walls, whereas he wanted large tubes. Messrs. Yarrow, as marine engineers, were accustomed to the conditions imposed by a feed make-up of 10 per cent. or less, whereas his views were governed by the fact that the feed make-up would be 100 per cent.

His reason for considering a steam temperature of 900 deg. Fah.—as at first obtained—too high was simply that he did not want to proceed too far at first. He thought that a temperature of 700 deg. and a pressure of 450 lb. were ample with which to start. In future high-pressure locomotives there would be no objection, so far as he could see, to going to 900 deg. In the design of "No. 10,000" the tendency had been to go too far in everything on the principle that afterwards it would be easy to cut down, but difficult to increase the characteristics of the engine. The grate area was undoubtedly bigger than was required, the whole boiler was too big, and the superheater, as originally planned, was too large. Mr. King had expressed surprise that he could get a temperature of 700 deg. from the small superheater surface finally provided. The explanation was to be found in the fact that his superheater surface was not, as usual, disposed inside fire tubes, but was subjected to the direct action of the radiant heat from the fire, a fact which made each square foot of the superheater surface many times more effective than in the usual type of superheater.

There could be no doubt as to the intention of the Delaware and Hudson Railway to continue its work on high-pressure engines. He had been in America in 1929, and had found Mr. Edmonds of that railway most enthusiastic concerning their merits. He agreed with Major Gregson concerning the origin of the very hard thin scale deposited in the fire-box tubes. It was undoubtedly to be traced to the permanent hardness in the water derived from the magnesia limestone districts through which the engine operated. He believed that if the water used in English engines could be treated before it was used in such a way as to make it equivalent to the water which was available without treatment in Scotland, the expenditure on the water treatment plant would be repaid in a very short time by the decrease in the locomotive maintenance costs. As an instance, he referred to an engine which he had inspected at the Cowlairs works after it had run 90,000 miles on the Glasgow–Edinburgh–Newcastle section. Not a single stay required renewing. Had that engine run for the same distance south of the Tweed, it would, he said, probably have needed 200 or 300 new stays. In Scotland, because of the purity of the water, the life of a copper fire-box was two to three times what it was in England.

ELECTRIC POWER IN THE BANK OF ENGLAND.—In a paper on "Modern Buildings as Engineering Structures," read by Dr. Oscar Faber before the Institution of Structural Engineers on February 12th, the author said that in the new Bank of England building it was found better to generate the electrical power—the total installation being about 3900 kW—than to take this great load from the public supply companies, by reasons of greater reliability and greater economy. The economy is effected, not only by the elimination of the enormous costs of distribution entailed by the distributing cables, but also for a scientific reason. It is well known that a heat engine working within definite limits of temperature can only convert into mechanical power a small proportion of the total heat value of the fuel, in the case of steam engines 20 per cent. and in the case of Diesel engines 30 per cent. In the Bank of England it was found that by co-ordinating the generating station with the heating installation most of the waste heat could be turned to useful account. Thus the water circulated to warm the building is passed first through the cylinder jackets of the Diesel engines, and the whole of the 30 per cent. absorbed there is employed for a useful purpose. The water then goes on to waste heat boilers fed entirely from the exhaust gases of the engines, where another 20 per cent. of the 30 per cent. available out of these boilers is absorbed, leaving about 10 per cent. to go to the exhaust gases, and the remaining 10 per cent. wasted in friction and radiation losses, with the result that the thermal efficiency of the installation is increased from about 30 per cent. to about 80 per cent. Indeed, the Bank is going to make a saving on its electricity account amounting into a sum running well into five figures per annum, and in addition will get its building heated practically free of cost. It is true that in the summer time there is not nearly so great a demand for heat by the building, though domestic hot water is still required, but the consumption of electricity is also reduced at this period, and a small cooling plant placed on the roof is able to absorb the heat which the domestic hot water is unable to accept.

The British Industries Fair.

No. I.

THE British Industries Fair, which will be opened in London and Birmingham on Monday, and will remain open until February 27th, promises to be one of the most successful which has been held. Its venues are the familiar buildings—Olympia and the White City for the lighter exhibits and Castle Bromwich, near Birmingham, for the heavier machinery. In both cases the patronage this year considerably exceeds that of any previous occasion, and it appears that there will be more novelty than usual. In the 8-page Supplement which accompanies this issue, we give particulars of some of the prospective exhibits, and below we describe others. As is our usual custom, the order of the notices is fortuitous, and there has been no attempt to classify them in any way.

S. RUSSELL AND SONS.

The principal exhibit on the stand of S. Russell and Sons, Bath-lane, Leicester, will be the high-speed circular sawing machine for metal, illustrated by Fig. 1. The saw blade is of the inserted segment type, and in the case of the machine exhibited it is 36in. in diameter, with thirty segments.

As will be seen from the engraving, the machine is of the type in which the saw is advanced towards the work piece and makes the cut in an upward direction. The saw is overhung on its spindle and is driven by a worm in the base, and a phosphor bronze worm wheel through spur gearing. At the left-hand end of the base there is a gear-box which gives five rates of feed with a maximum of 6in. per minute.

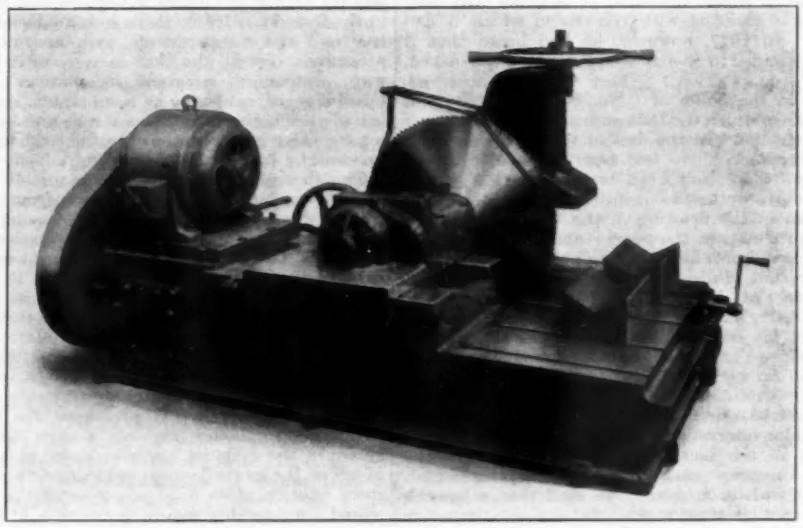


FIG. 1—HIGH-SPEED METAL SAWING MACHINE—RUSSELL

There are also a quick power-driven return motion, and a large hand wheel for the close setting of the saddle. Automatic stops are fitted to prevent the saddle over-running in both directions. The whole of the gears are built up as a unit, and can be easily removed from the main box. Above the box there is provided accommodation for a driving motor, of 12 horse-power, as shown in the illustration, or fast and loose pulleys can be mounted there if the machine is to be belt driven. A special form of vice has been devised for holding the work piece and grips in a downward direction. It can be seen behind the saw in the illustration. The job is clamped down on to the bed by means of the star wheel, and is held up against the vertical face of the vice by the V blocks shown. For holding round work, the V blocks are brought up right underneath the vice. The vice is reversible on either side of the saw. The machine is made in five sizes, with saws ranging down to 20in. in diameter. That to be exhibited will cut joists up to 24in. by 7½in., rounds up to 12½in., and squares of 11½in. The cut is ⅛in. wide.

THE DAVIS FURNACE COMPANY.

There will be two gas-fired furnaces on the stand of the Davis Furnace Company, of Diamond Foundry, Luton, which are illustrated by the drawings, Figs. 2 and 3. The oven type of furnace shown in Fig. 2 has a working chamber 4ft. 7in. long by 2ft. 2in. wide by 1ft. high. It is built of highly efficient insulating materials, and the structure is of rigid design, comprising a series of vertical buckstays, tied laterally and longitudinally by heavy section steel plates, tie bars, cast iron thrust plates, &c. At the front end of the furnace there is a geared rise-and-fall counterbalanced door of heavy section. The gear for the operation of the door is adjacent to the control quadrant, on the left-hand side of the furnace, so that the reversing lever, the gas and air control quadrant with a vernier indicator and gear operation are all situated in close proximity. The reversing gear, whilst being operated from the front of the furnace, is neatly housed at the back of the furnace. The operating parts are removed from the side of the furnace as far as possible, so as to enable batteries of furnaces

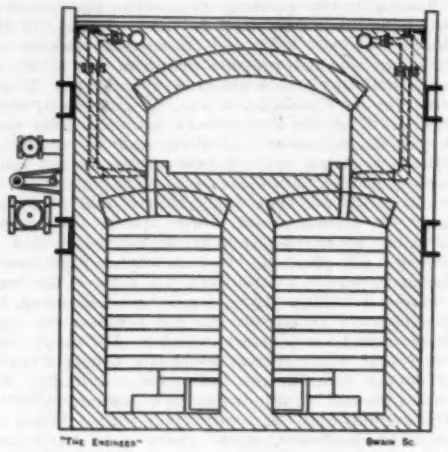


FIG. 2—OVEN TYPE FURNACE—DAVIS

to be built very close to each other, thus economising room—in fact, the construction is such that multiple-chamber batteries can be built in solid units, economy in floor space, material and fuel thereby being effected. This furnace is fitted with an electrically-operated automatic reversing gear, especially designed to meet the requirements, by Venner Time Switches, Ltd., in collaboration with the Davis Furnace Company, and with an electrically-operated automatic temperature control designed by Electroflo Meters, Ltd.

On the stand of this company there will also be seen an interesting development in the semi-automatic forging

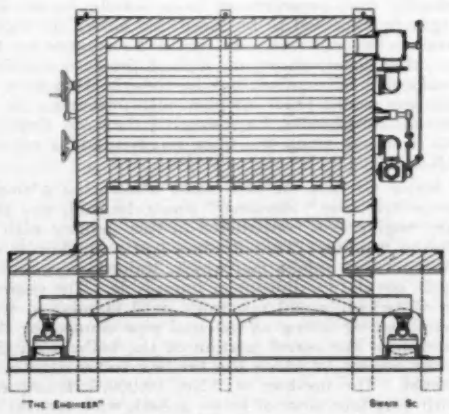


FIG. 3—FORGING TYPE FURNACE—DAVIS

type furnace, as shown in Fig. 3. This furnace, which has a heating chamber 6ft. long by 1ft. 6in. wide by 10in. high, has been developed as the result of extensive investigations and tests carried out at the company's works at Luton, with a view to raising the efficiency of the open-fronted type of forging furnace beyond that usually obtained in this class of apparatus. The regenerators in this case are arranged above,

not below, the working chamber. The flames are projected in a downward direction, first on one side and then on the other side of the furnace chamber, crossing the floor and passing out through the ports on the side opposite to that by which the flames enter. The flames are transferred from side to side of the furnace periodically in accordance with the reversing principle. By making use of draught-inducing contrivances the products of combustion can be prevented from escaping through the openings at the back and front of the furnace, thus ensuring the full utilisation of the "Revergen" principle, with its resulting saving in gas.

The automatic arrangement consists of a reciprocating centre section of the floor. This centre section is built up of specially moulded refractory materials, and projects downwardly on to a steel mounting, which is carried backwards and forwards. The mounting is supported by crank shafts situated in such a position that they are adequately protected from the effects of heat. These crank shafts are in turn operated by a side shaft, and two pairs of worms and worm wheels, driven by any convenient means at a speed adjusted to give the necessary output in bars heated per hour.

The movement of the crank shaft transmits to the centre section of the floor first an upward and forward movement, and then a downward and backward movement. During this latter half of the cycle the centre section of the floor is below the ordinary level. When the upward and forward half of the cycle starts, the bars are all simultaneously raised and carried forward 3in., or any other distance that may be required, so that a bar placed on the floor of the furnace at the entry end progresses by a series of 3in. steps towards the delivery end, by which time it is adequately heated to the required temperature.

BABCOCK AND WILCOX, LTD.

The principal exhibit on the stand of Babcock and Wilcox, Ltd., will consist of a series of heavy oil engines of the medium compression and cold-starting

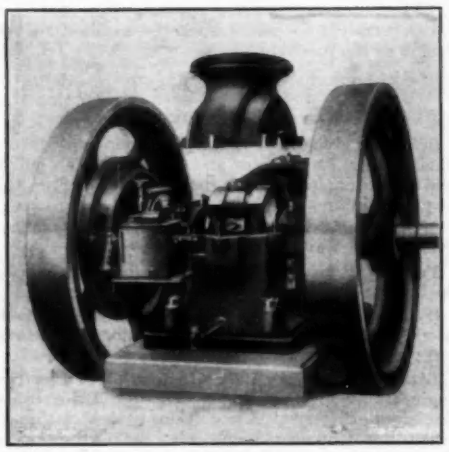


FIG. 4—CRANKCASE COVER RAISED—BABCOCK

types. In Fig. 6 we reproduce a section through a medium compression oil engine, to be shown in operation, which is a 15 B.H.P. unit, with a cylinder bore of 8½in. and a stroke of 9in., designed to run at a normal speed of 375 r.p.m. This type of engine was originally built to the design of Clayton, Shuttleworth and Co., Ltd., of Lincoln, and it now embodies

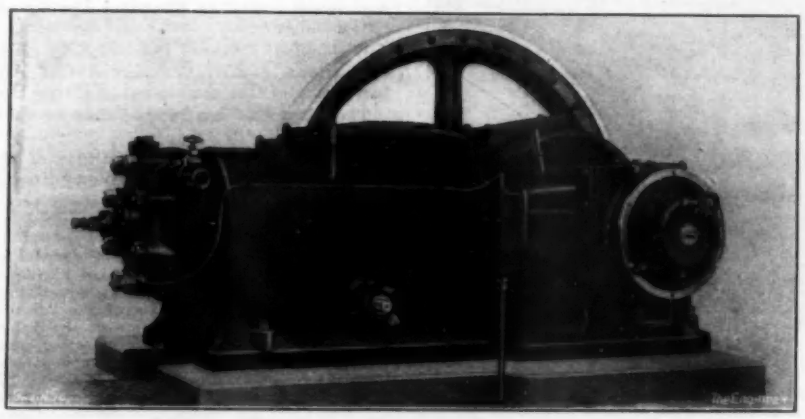


FIG. 5—33 B.H.P. COLD-STARTING OIL ENGINE—BABCOCK

several improvements. One of the outstanding features of the design is the removable crank case cover. In Fig. 4 the cover is shown raised, giving free and easy access to the large end bearing of the connecting-rod. The cover is held in position by five bolts, and the inclined joint on the cylinder side of the cover is specially designed to render the crank case air and dust-tight when the cover is screwed down. The large circular cover over the air inlet valves is provided with an overhung lip, so that no dust or grit can fall on to the working parts. In particular cases, such as in quarries, brickyards, flour mills, and timber yards, where dust is liable to enter with the air, a special air filter is attached to the top cover. As may be gathered from our engraving, the engine works on the two-stroke principle with crank case scavenging. Mechanical lubrication is supplied to the principal working parts; the main bearings, however, are ring lubricated from dust-proof oil wells arranged in the casting below the main bearings. The governor is of the spring-loaded crank shaft type, and it operates directly on the fuel pump. For starting a heating lamp is employed, which is, however, only used until the engine has been run up to speed.

Another engine exhibit which will be shown in operation running on fuel oil will be the 33 B.H.P. cold-starting oil engine shown in Fig. 5. It is designed to run at 320 r.p.m., and has a cylinder bore of 10in., with a stroke of 14in. The features embodied in the design of the Babcock and Wilcox cold-starting engine are in the main those of the medium compression type of engine described above, but some differences may be noted. The air enters the inside of the bedplate through gauze-protected louvres and passes to the top of the cylinder jacket to a large rectangular casing in which the air inlet valves are arranged. After being compressed in the crank case the scavenge air enters the cylinder through ports at the top, the exhaust ports being situated on the opposite or bottom side of the liner. We may draw attention to the very simple and symmetrical cylinder head and the clean lines of the cylinder casing and bedplate. The fuel pump, which is of the governor-controlled spill-valve type, is enclosed in a casing attached to the governor casing. A hand priming lever and a hand speed regulating gear, giving a 6½ per cent. increase or decrease in speed with the engine in operation, are fitted. The engine is very simple to operate and is easily started on compressed air. It recently gained a Dublin award for its extreme simplicity and the low working cost.

The firm will also show specimen plates of its interlock open steel flooring, which, it is claimed, is the only steel flooring manufactured with a complete surround which enables it to fit round pipes, columns, and similar obstructions without impairing the strength of the panel. On account of the interlocked construction, the members forming the panel have strength in all directions. The transverse and longitudinal strips, which are interlocked with each other, form open squares of 1½ pitch, and the largest size of panel recommended is about 6ft. by 4ft., spans of 4ft. 6in. not being recommended on account of the excessive deflection. Some idea of the strength of an interlock flooring panel may be obtained from the fact that a 4ft. by 2ft. panel supported on its two long sides and loaded by weights aggregating 1 ton laid along its centre line only deflected 0·021 in., while when supported on its two short sides with a 14 cwt. load at the centre it was only deflected 0·56in. The

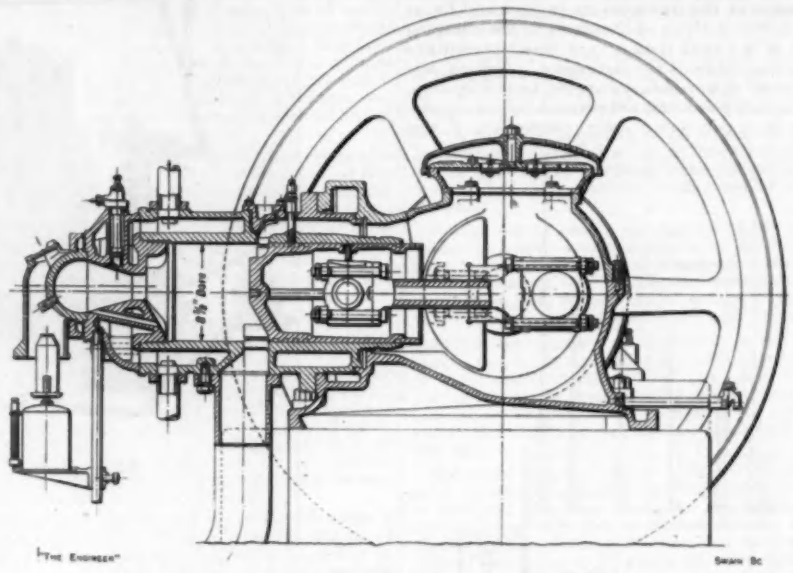


FIG. 6—15 B.H.P. MEDIUM COMPRESSION OIL ENGINE—BABCOCK

examples to be shown will be illustrative of the many uses to which this special type of open steel flooring may be put.

THE CONSTRUCTIONAL ENGINEERING COMPANY, LTD.

There will be a novel form of boiler on the stand of the Constructional Engineering Company, Ltd., Charles Henry-street, Birmingham. It is illustrated in Fig. 7. It is, it will be seen, of the vertical type, with a water chamber running across the fire-box. There are circulating tubes running from this chamber to the crown of the fire-box and to the water spaces around the bottom of the box. A chamber is riveted on to the side of the shell casing, and in this a tube plate is fitted. There is another tube plate on the opposite side of the water chamber, and between the two there is a nest of fire-tubes. The tubes are set

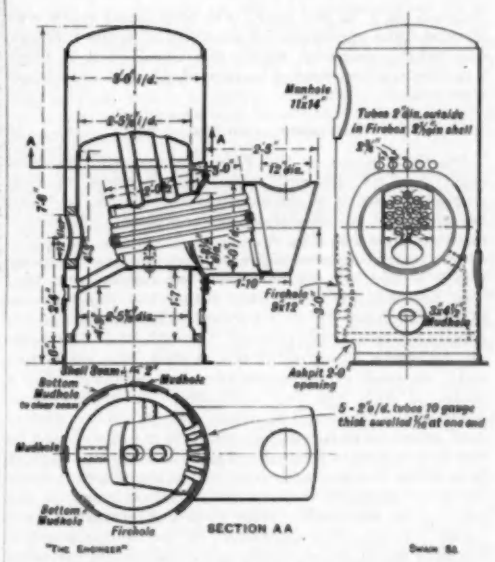


FIG. 7—VERTICAL BOILER—CONSTR. ENG. CO.

with an upward inclination of 10 deg., which, it is claimed, assists the flow of the gases to the chimney. There is a door in the side of the shell to enable the tubes to be swept clean and the fire-hole is in the side, at right angles to this door.

The cupola illustrated by Fig. 8 is of the Poumay type and is noteworthy on account of the arrangement of the tuyeres. The main design of this cupola is similar to that of the standard "Titan" rapid-melting cupola, with the exception of the tuyere arrangement. The main tuyeres are in two rows and are fitted with Wood's patented tuyere slides. The lower, or fusion, tuyeres are rectangular in section and splayed outwards towards the interior of the cupola. The upper, or preparation, tuyeres are also rectangular in section, but are not splayed, and have two openings on the interior of the cupola, one being radial and the other tangential. Auxiliary or regeneration tuyeres

are arranged spirally above the wind belt. The application of this system to cupolas, is claimed to result in (1) a large reduction in fuel consumption; (2) hot metal; (3) a reduction of sulphur content; (4) a rapid melt, and (5) a minimum of metallic loss, while (6) patching costs are reduced to a minimum. With this system CO is produced under the melting zone and not CO_2, as in an ordinary cupola. The beneficial effect of this is proved by the fact that slag from a Poumay cupola usually contains less than half the iron oxide present in the slag of an ordinary cupola. This CO is supplied with oxygen above the melting zone by means of the regeneration tuyeres and forms CO_2. By actual analysis of the gases at the charging hole level, it is found that a very small percentage of carbon monoxide—CO—is present. Taking one particular case of a cupola converted to this system, to illustrate this point, the CO present before conversion was 10·5 per cent.; after conversion it was

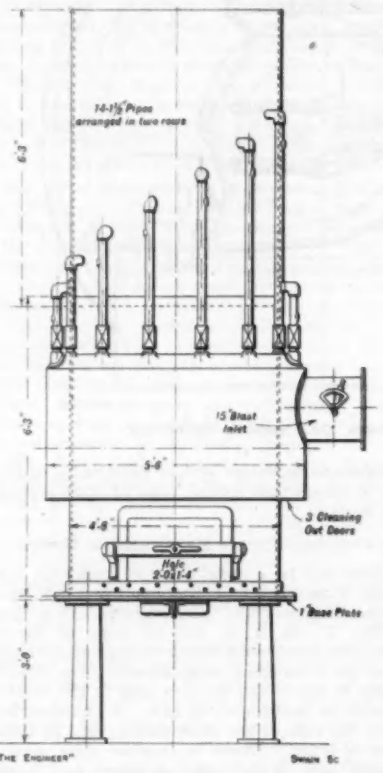


FIG. 8—CUPOLA—CONSTRUCTIONAL ENGINEERING CO.

reduced to 0·12 per cent. On this stand there will also be some specimens of an artificial stone mixture for making patterns, which sets quite hard in from 6 to 8 hours, but can yet be turned, planed, or finished with a file.

DAVIDSON AND CO., LTD.

On their stand at the Fair, the firm of Davidson and Co., Ltd., Belfast, is, on this occasion, making a special feature of air conditioning plants, and will be showing in operation a complete "Sirocco" unit, as shown in Fig. 9.

The unit comprises a preliminary air heater, spray water heater, air washer, main air heater, and fan. The preliminary air heater raises the temperature of the incoming air to a predetermined degree above freezing point. In passing through the fine mist in the spray chamber of the washer, the air is not only cleansed of its impurities, but acquires also a state of high relative humidity. A thermostatic regulator is fixed at the outlet end of the air washer and arranged in a position where it is not exposed to the free moisture from the washer, nor to the radiant heat from the main heater. It is, therefore, subject to the saturation, or dew point temperature of the passing air, saturation being obtained by warming the spray water. Any alteration in the temperature is transmitted by the regulator to the diaphragm valves on the preliminary heater and spray water heater, which will open to admit more steam or close according to the conditions. The air is, therefore, always saturated and at a constant temperature. In the air washer, the number of eliminator plates provided is sufficient to ensure that all free moisture in the air current is entirely extracted and all risk of trouble due to entrained water is obviated. Upon leaving the washer the air is re-heated by the main heater to a predetermined temperature, which automatically gives the required humidity. This temperature is kept constant by a second regulator. Impulse is given to the valves and the regulators through the medium of compressed air from a small compressor unit. The recording instruments on the panel beside the unit show not only the temperature and humidity characteristics of the air in the main building, but also those of the air supply being discharged by the unit.

The "Sirocco" steam turbine heater unit, which is to be shown in operation on this stand, is intended for heating workshops where the cubic content of the building is large in comparison with the number of occupants therein, and where, consequently, heat is the main factor and ventilation is of a secondary importance. In this unit the power for operating the fan is provided by the steam required for heating purposes. No electric wiring is required, only steam and drain connections being necessary, while the warm air is delivered near the floor level where it is most needed.

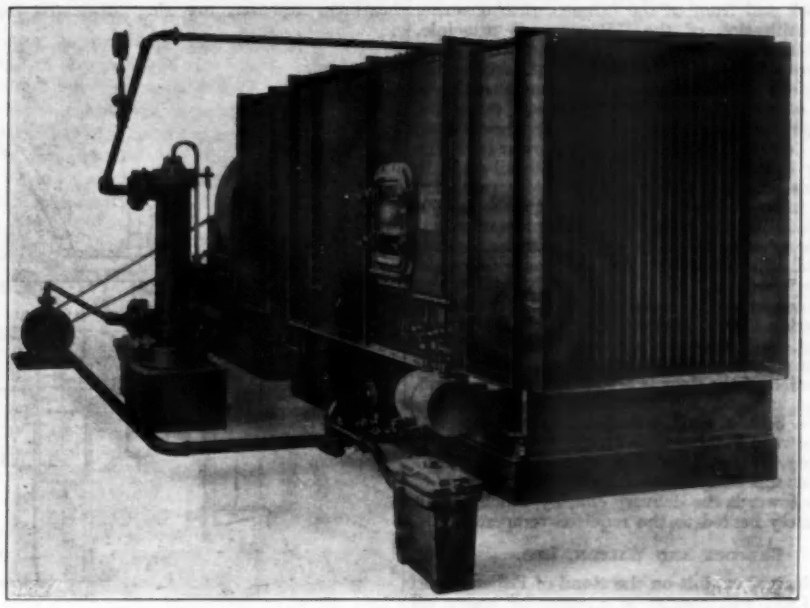


FIG. 9—"SIROCCO" AIR CONDITIONING PLANT—DAVIDSON

Another exhibit will be the wheel of a "Sirocco" induced draught fan, complete with its bearings. The wheel is 80in. in diameter and is one of forty-eight "Sirocco" mechanical boiler draught fans on order for the Battersea super-power station. The fan in question is designed to deal with 51,500 cubic feet of gases per minute against 15¼ water-gauge.

PNEULEC, LTD.

A distinctly novel item of foundry equipment will be shown on the stand of Pneulec, Ltd., Mafeking-road, Smethwick, Birmingham. It is illustrated in

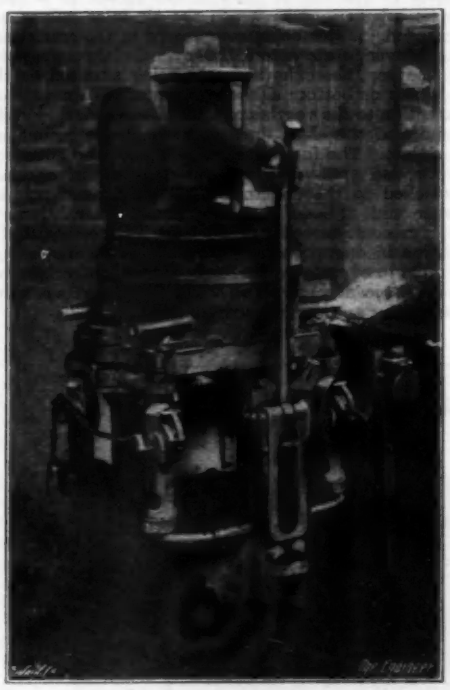


FIG. 10—SQUEEZE MOULDING MACHINE—PNEULEC

Fig. 10, and comprises a squeeze moulding machine operated electrically.

The force necessary for squeezing the mould is provided by the direct action of an electric solenoid, which is entirely enclosed, so that sand and moisture cannot get into the coil or any of the working parts. The solenoid of the standard machine is wound for a D.C. supply of 240 volts, and at that pressure requires about 100 ampères for the squeeze. As, however, the operation only lasts for a few seconds, the actual consumption of energy is quite small, while the scheme has the advantage that no auxiliary machinery, such as air compressors or hydraulic pumps, need be installed. The machine can be connected up directly with the ordinary electric power circuit, and is said to work very smoothly, without jerks. The speed of drawing can be regulated by varying the viscosity of the oil used in the dashpot. The height of the pattern table and the squeeze head can be set as required, and the stroke varied from 4in. downwards. Only one push-button is required for the control of the machine.

(To be continued.)

OFFICIAL ENGAGEMENTS.

Below we give a list of the arrangements, such as official visits, conferences and lunches, which will be held at Birmingham during the course of the Fair, that may be of interest to engineers.

Monday, February 16th, Opening Day.—Official visit of Lord Mayor of Birmingham.

Tuesday, February 17th.—Institution of Mechanical Engineers; British Engineers' Association.

Wednesday, February 18th.—Ironmongers' Federated Association (Inc.); British Junior Gas Association; Inter-Universities Metallurgical Congress.

Thursday, February 19th.—Institution of Electrical Engineers, South Midland Centre Incorporated Municipal Electrical Associations; Association of Consulting Engineers; Association of Supervising Electrical Engineers; Electrical Contractors' Association (Inc.).

Friday, February 20th.—Birmingham and District Association of the Institution of Civil Engineers; Institute of Metals; Institute of Welding Engineers.

Saturday, February 21st.—Electrical Power Engineers' Association.

Monday, February 23rd.—British Cast Iron Research Association; Institute of British Foundrymen.

Tuesday, February 24th.—Institution of Electrical Engineers—Council; British Electrical Development Association; British Electrical Development Association—dinner.

Wednesday, February 25th.—Society of British Gas Industries; British Commercial Gas Association; Institution of Gas Engineers; National Gas Council.

Thursday, February 26th.—Ironmongers' Federated Association (Inc.).

Friday, February 27th.—Institute of Quarrying; Institution of Municipal and County Engineers.

IN the *Westinghouse International Journal* for January there is an interesting account of a device for controlling traffic which is being adopted in several towns in the U.S.A., and is a modification of the "Stop and Go" light system. In many main streets the traffic is always heavier than on a little-used intersecting street. Hence the traffic may be held up in the main street, although there are no vehicles using the side street. In order to obviate this drawback, a device is used in connection with the "Stop and Go" light, whereby the latter only shines red down the main street when a motor vehicle approaches the intersection from the side street. The device is based on the principle of the photo-electric cell, and is mounted on a pedestal 3ft. above the curbstone in the side street, near the crossing. When a vehicle approaches from the side street it necessarily has to stop, and in this position it intercepts a beam of light which falls on a device called the "electric eye." The interruption of this light beam automatically changes the visible signal facing the side street from red to green and the signal in the main street from green to red for an interval long enough to enable the motorist to cross the main street.

Railway and Road Matters.

IT is estimated that the greater part of the £355,000 decrease in the G.W.R. revenue in the first three weeks of the year as compared with 1930, was due to the coal stoppage in South Wales. In addition, a further £85,000 decrease was recorded in docks receipts.

THE retirement on March 31st is announced of Mr. W. G. P. Maclure, the locomotive running superintendent for the southern area of the London and North-Eastern Railway. Mr. Maclure will be succeeded by Mr. S. Groom, the running superintendent for the Scottish area.

MENTION was made in our annual article "Railways in 1930" in THE ENGINEER of January 16th, of a widening of the line between Romford and Romford Factory Sidings. On Sunday, January 25th, trains were turned on to the widened lines in order that the necessary changes could be made in the existing tracks. That has necessitated a reduction in speed on all trains through Gidea Park and Romford.

THE Bishops Castle Railway, not being of the standard gauge, was excluded from absorption under the Railways Act, 1921. The local authorities passed a resolution requesting the Minister of Transport to promote legislation to compel the Great Western to take the line over. The railway company has replied that there are no prospects of developing the traffic which would justify the expenditure which would be required to make the line suitable.

THE President of the Institution of Railway Signal Engineers for the session of 1931–32, inducted at the annual meeting of that body on Wednesday last, is Mr. James Punter, of whom it is interesting to know that, like his grandfather, father, and two brothers, he commenced his signalling career with Saxby and Farmer. Mr. Punter is the first President, since the Institution was founded in 1912, to be selected from outside the circle of railway companies, but he brings to the presidency the honour of being connected with Tyer and Co., a firm which has been in business for eighty years.

THE Canadian Pacific Railway, the jubilee of which fell on Wednesday, February 11th, is claimed to be the world's greatest travel system under one management. It controls and operates over 21,000 miles of railway track, half-a-million tons of shipping on the Atlantic and Pacific Oceans, 130,000 miles of telegraph wires, a chain of hotels, and large land, mining and industrial interests. Its assets now total over £268,000,000. The company maintains a fast steamship service between British ports and the Far East, and when the "Empress of Britain" enters the Atlantic service it will be possible to reach Yokohama by way of Canada and the Pacific in seventeen days.

SOME further particulars of the Clacton branch fatal collision of January 16th, supplementing those recorded in our issue of January 30th, were given at the resumed coroner's inquest on the 31st. The guard with the newspaper train admitted that he gave a "right away" signal to the driver. He could not see the fixed signals; if he had known that they were at "danger," he would not have done so. Answering a question, the stationmaster at Thorpe-le-Soken admitted that had Great Holland signal-box been open it would have been possible to stop either or both of the trains. It will be remembered that this signal-box is only open in the summer, in order to deal with the extra traffic at that time. A verdict of "Accidental death" was recorded.

IN our "Sixty Years Ago," on page 109 of THE ENGINEER of January 23rd, we related how our issue of January 27th, 1871, commented upon the late appearance of what are now known as the Railway Returns for the year 1868, to be followed almost immediately by those for 1869. It may be interesting to recall that the delay in the issue of the figures for 1868 was due to their being the first prepared in accordance with the schedules attached to the Regulations of Railways Act, 1868. The same explanation could be offered for the apparent inaccuracies in the Returns, because, as often is the case with new forms, it is some time before the methods of the various companies are standardised. It was the same with the Railway Returns for 1913, which were the first to be issued under the Railway Companies (Accounts and Returns) Act, 1911.

BHADRAVATI, in the Mysore State, is adding one more to its many industrial activities in the form of an installation for sleeper treatment. This installation has been decided upon after consultation with the different South Indian railways and the Forest Department to meet a long-felt need for a dependable sleeper treatment plant and obviate the present costly expedient of importing wooden sleepers. The establishment of the plant, which will be the first of its kind in South India, has been facilitated by the availability of wood tar creosote at the ironworks at Bhadravati. The tar has been successfully tested at the Forest Research Institute at Dhera Dun, India, and at American laboratories. Schemes of a total cost of 2,81,787 rupees have been approved of by the Financial Committee of the Madras Legislative Council for obtaining sleepers in the Silent Valley Forest, in the Palghat Division, and other forests.

THE Board of Trade Returns for December last show the value of the railway material exported during the year 1930 to be as follows, the corresponding figures for 1929 and 1928 being added in brackets:—Locomotives, £3,751,189 (£3,275,153, £3,501,220); rails, £2,084,558 (£2,756,167, £3,437,000); carriages, £1,844,799 (£2,418,489, £2,475,176); wagons, £3,176,767 (£2,397,510, £3,088,735); wheels and axles, £376,982 (£419,404, £742,194); tires and axles, £668,314 (£630,829, £592,283); chairs and metal sleepers, £609,946 (£520,274, £864,778); miscellaneous permanent way, £863,709 (£1,052,474, £1,306,456); total permanent way material, £4,707,011 (£5,546,021, £7,079,948). The weight of the rails exported was 239,230 tons (326,075 tons, 393,667 tons), and of the chairs and metal sleepers, 63,975 tons (51,773 tons, 81,114 tons). The value of the locomotives shipped overseas in December last was £174,810 and included the Argentine £96,621, India £12,924, and other countries than the Argentine in South America £9667. The value of the rails exported during the same month was £39,910, which included the Argentine £15,649, South Africa £11,788, India £5707, Australia £1948, West Africa £1430.

Notes and Memoranda.

THE total population of Shanghai is over 3,000,000. The American population is 3614, the British 9331, the French 1776, the German 1610, the Japanese 25,650, and the Russian 7687.

THE heaviest railway metals ever used in Canada are being rolled by the Dominion Steel Company of Sydney, Nova Scotia. They are of 130 lb., and are to be used by the Canadian National Railways.

WHAT is claimed to be the most powerful motor wagon ever built, designed to carry loads of from 20 to 40 tons at speeds hitherto considered impossible, has been announced by the Relay Motors Corporation, Lima, Ohio. This large transportation unit is equipped with two eight-cylinder truck type engines, with a combined rating of 275 B.H.P. at 2800 r.p.m. The truck is mounted on six wheels, and each motor delivers power to a separate rear axle through a separate transmission and differential.

AN instance of the merits of oxy-acetylene welding in constructional work is given by H. E. Rockefeller, of New York. A rotary kiln, 120ft. long by 9ft. in diameter and ¼in. thick, was being made when it was found that the carrying rings had been wrongly placed. Instead of scrapping the tube, which would probably have had to be done had it been a riveted structure, it was cut with the blow-pipe and a length transferred from one end to the other, with the addition of only one extra joint in the whole length.

IN welding wrought iron pipe with the blow-pipe, it is essential, says *Industrial Gases*, that a puddle of molten metal be maintained at the point where the rod is being added, the end of the rod being kept submerged in this molten puddle until enough metal has been deposited. The edges of the molten puddle should then be fused with the surrounding colder metal to form a solid union. This operation is repeated, care being taken that no welding rod is added except through the molten puddle. This puddle should be agitated as little as possible, so that a sound weld may be obtained.

A SHIPMENT of 150 tons of solid carbon dioxide recently arrived in New York City from the Tampico district of Mexico. The carbon dioxide supply was, according to *Food Industries*, accidentally discovered some time ago by a petroleum company while drilling for oil. The gas is said to come to the surface under a pressure of 1000 lb. per square inch, and to be available in sufficient quantities to produce 1600 tons of solid carbon dioxide daily. The present plant capacity for purifying and solidifying the gas is said to be about 40,000 lb. per day. For transporting the product from the Tropics a nine-day voyage is required. About 12in. of cork-board is used to insulate the compartments in which the blocks are stored for shipment.

SPEAKING at a meeting of the Midland Section of the Coke Oven Managers' Association, Mr. J. H. Hodsman said that headway would not be made in the use of coke for domestic purposes until the ash content of coke was comparable with that of normal house coal. Next, it was necessary to recognise that all cokes differed from coals. They ignited at higher temperatures. The so-called "ignition temperatures" were in round figures, say, about 200 deg. Cent. for coals, 300 deg. and over for low-temperature cokes, 400 deg. and over for gas cokes, and about 500 deg. for oven cokes—those differences being due to the varying reactivities towards oxygen below a red heat. Those figures accounted for the differing ease of ignition of cokes in the grate and the tardiness with which a fire might brighten up on replenishment. This was accentuated by the lack or even complete absence of volatile matter, the flames of which provided a more effective means of transferring heat about a fuel bed than the hot inert products of combustion from a coke.

BEFORE the extensive use of wireless in the U.S.A., the commercial development of tantalum had been very small and spasmodic. The demand for a cheap and simple means for converting alternating electric current into direct, however, drew attention to the possibilities of metallic tantalum. This demand for the metal led to its production on a much larger scale than hitherto, thus making it available for other commercial uses and enabling its properties to be more thoroughly investigated than had hitherto been possible. The metal is stated to be suitable for many chemical, physical and industrial purposes for which it has become a rival to platinum. The Imperial Institute has just issued a monograph on this rare metal, and its less-known sister metal, niobium, giving a considerable amount of information concerning the properties and uses of both. The book is devoted mainly to descriptions of the more important occurrences of tantalum and niobium minerals, the chief sources of supply being Western and North Australia. The monograph can be obtained from H.M. Stationery Office, price 6d.

THE following are the conclusions arrived at by Dr. J. W. Donaldson in a paper read before the West of Scotland Iron and Steel Institute:—(1) The strength of grey cast iron "as cast," at temperatures between 15 deg. and 600 deg. Cent., first decreases slightly to a minimum, then rises to a maximum before falling off rapidly. (2) The minimum and maximum temperatures and the magnitude of the resulting depression in the temperature-stress curve are influenced by the silicon content of the iron and additions of such elements as chromium, tungsten, manganese, nickel, and vanadium. (3) Heat treatment for a short period—four hours—at a low temperature—300 deg. Cent.—eliminates the depression in the temperature-stress curve. Such treatment also slightly improves the strength values due to the releasing of casting stresses. (4) Heat treatment at 450 deg. or 550 deg. Cent. for 200 hours reduces the strength values and gives rise to temperature-stress curves which fall off uniformly and regularly. (5) Temperature-stress curves obtained after heat treatment are of a similar nature and value to tensile-temperature-time curves derived from "creep" tests. (6) Iron with a low silicon content or containing small additions of chromium—0·4 per cent.—or tungsten—0·5 per cent.—has a high strength value at elevated temperatures. High silicon content or a small nickel addition—0·75 per cent.—lowers the strength considerably.

Miscellanea.

A STATE-OWNED cement works is being put up at Canton, at a cost of about £200,000. It will have a capacity of 1200 barrels a day.

ACCORDING to Dr. G. Rae, the total area of land occupied by rubber plantations was, at the end of 1929, between 6,600,000 and 7,200,000 acres. The output for 1930 was 820,000 tons.

STATISTICS compiled by the Aeronautical Chamber of Commerce show that American aircraft companies produced 2684 commercial and military aeroplanes in 1930, valued at 21,469,763 dollars.

THE seventh paper-making machine of the Powell River Company, near Vancouver, has just been started up. It is 226in. wide, runs at 1400ft. per minute, and brings the capacity of the mill up to 630 tons a day.

IT is proposed to put up an oil refinery at Coutts, near Lethbridge, Alberta, at a cost of 200,000 dollars. It will handle the oil from the Red Coulee oilfield on the International boundary, and will be financed by a New York company.

ACCORDING to the latest figures of the numbers of foreign technical experts employed by the Soviet Government in various branches of Russian industry, there are 11,000 Germans, 6000 Americans, and 250 Englishmen working in the Soviet Union to-day. Another 5000 Americans are expected during the next few months.

AFTER some months of experiment in the use of pulverised fuel for steam raising at the Grimethorpe Colliery of the Carlton Main Colliery Company, Ltd., South Yorkshire, it has been decided to turn over six more Lancashire boilers to pulverised coal. The original installation was described in THE ENGINEER of January 23rd last.

WIRELESS reports from the Antarctic announce that a catch of whales producing 206,500 barrels of oil, valued at £860,400, has been made by the Anglo-Norwegian Holdings fleet—the largest British Empire unit in the whaling industry—during the first seventeen weeks of the 1930–31 season, ended February 8th. This total compares with a yield of 175,530 barrels, valued at £731,375 for the same period in the 1929–30 season.

THE continued growth of the air mail services is revealed in a Post Office return, which shows that during the quarter ended December 31st, 1930, 24,740 lb. of letter air mail were carried from this country, as compared with 21,307 lb. during the corresponding quarter of 1929, an increase of 17½ per cent. The carryings to India were again larger than those to any other country—9330 lb., as compared with 7955 lb. in the December quarter of 1929.

DURING the month of January, schemes for widening, reconstruction and other improvements of classified roads and bridges, and for construction of new roads and bridges of classification value, involving a total estimated expenditure of £1,852,000, were formally approved for Road Fund Grants, and work should commence at an early date. The total value of road and bridge schemes now definitely approved for commencement is £28,000,000, whilst further schemes to the value of £26,000,000 have been approved in principle.

IT is reported that the General Electric Company intends to erect a power plant to cost four million dollars for its works at Schenectady. The plant will include a large mercury vapour turbine built in accordance with the invention of Mr. W. L. R. Emmet, of the General Electric Company. The new turbine is to have a capacity of 26,700 H.P. and is expected to result in a substantial saving in fuel compared with the ordinary steam generating equipment. The mercury required in the boiler will weigh 250,000 lb.

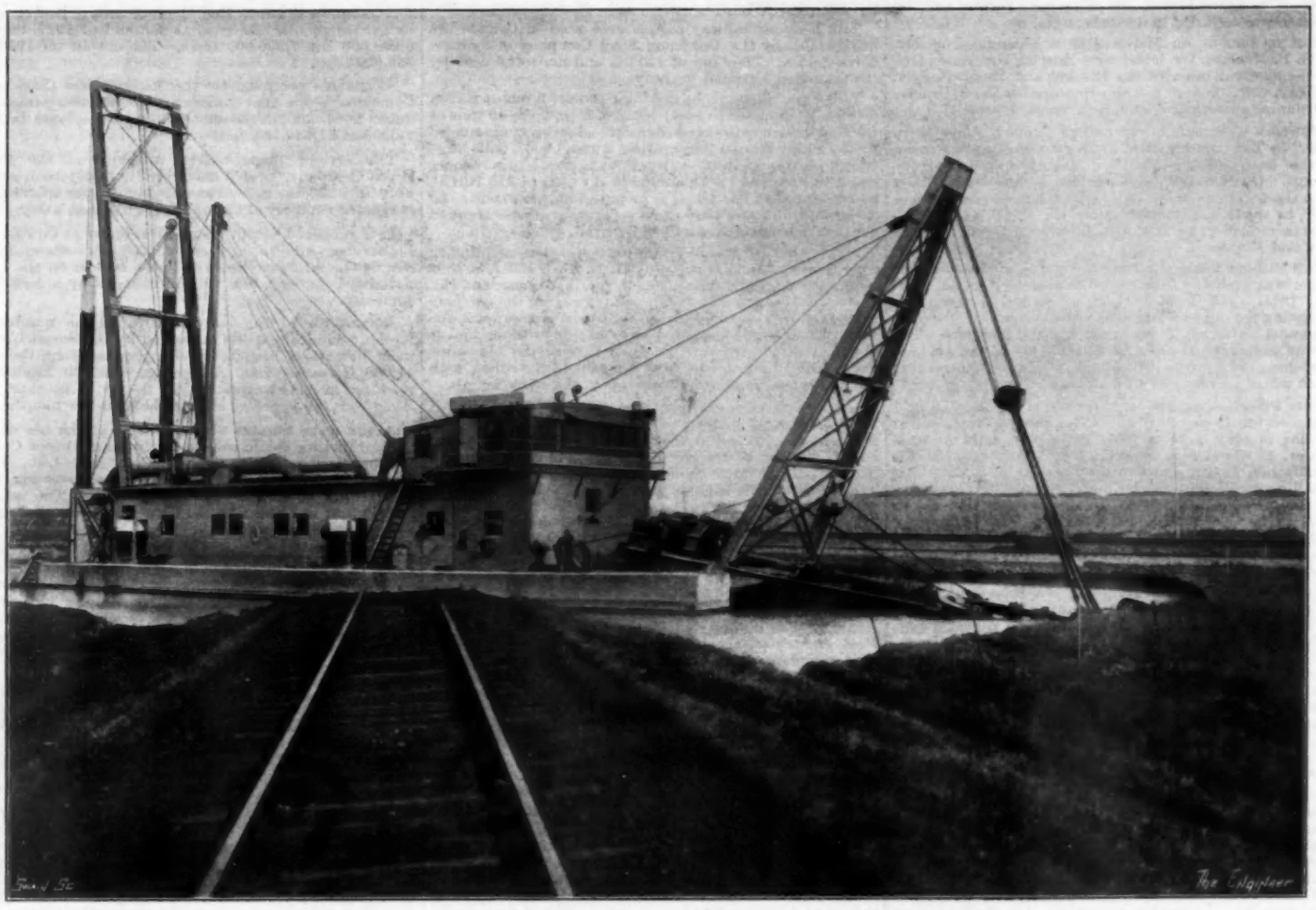
A DISCOVERY of banket reef carrying gold is reported in the *S.A. Mining and Engineering Journal* from the farm Rietmont, 15 miles east of Marienthal, in South-West Africa. From the Rouxville district of the Free State also comes news of the discovery of a gold reef giving upwards of 7 oz. to the ton. These two announcements coming close on the finds of banket in the Victoria district of Southern Rhodesia, serve to show that prospectors are fully alive to the value of a gold discovery at the present time. Until further information is available, of course, it is impossible to measure the importance of these reported discoveries.

THE recent visit to Moscow of the German airship "Graf Zeppelin" served as an impetus to a powerful movement in favour of Soviet-made airships, and funds began to be raised throughout the country for building several airships to serve as a basis for a whole fleet. Already over 4,000,000 roubles have been contributed, and a small experimental airship of 2500 cubic metres capacity is being built at Moscow, while another semi-rigid ship with a capacity of 7000 cubic metres is under construction at Leningrad. A group of specialists at Leningrad is also engaged in designing a 20,000 cubic metre airship. Special attention is being devoted to the idea of building all-metal airships, as suggested by the Russian specialist M. Tsiolkovsky, and the laboratory work in this direction is being conducted under M. Tsiolkovsky's supervision. A flying model of an all-metal airship is to be built this year.

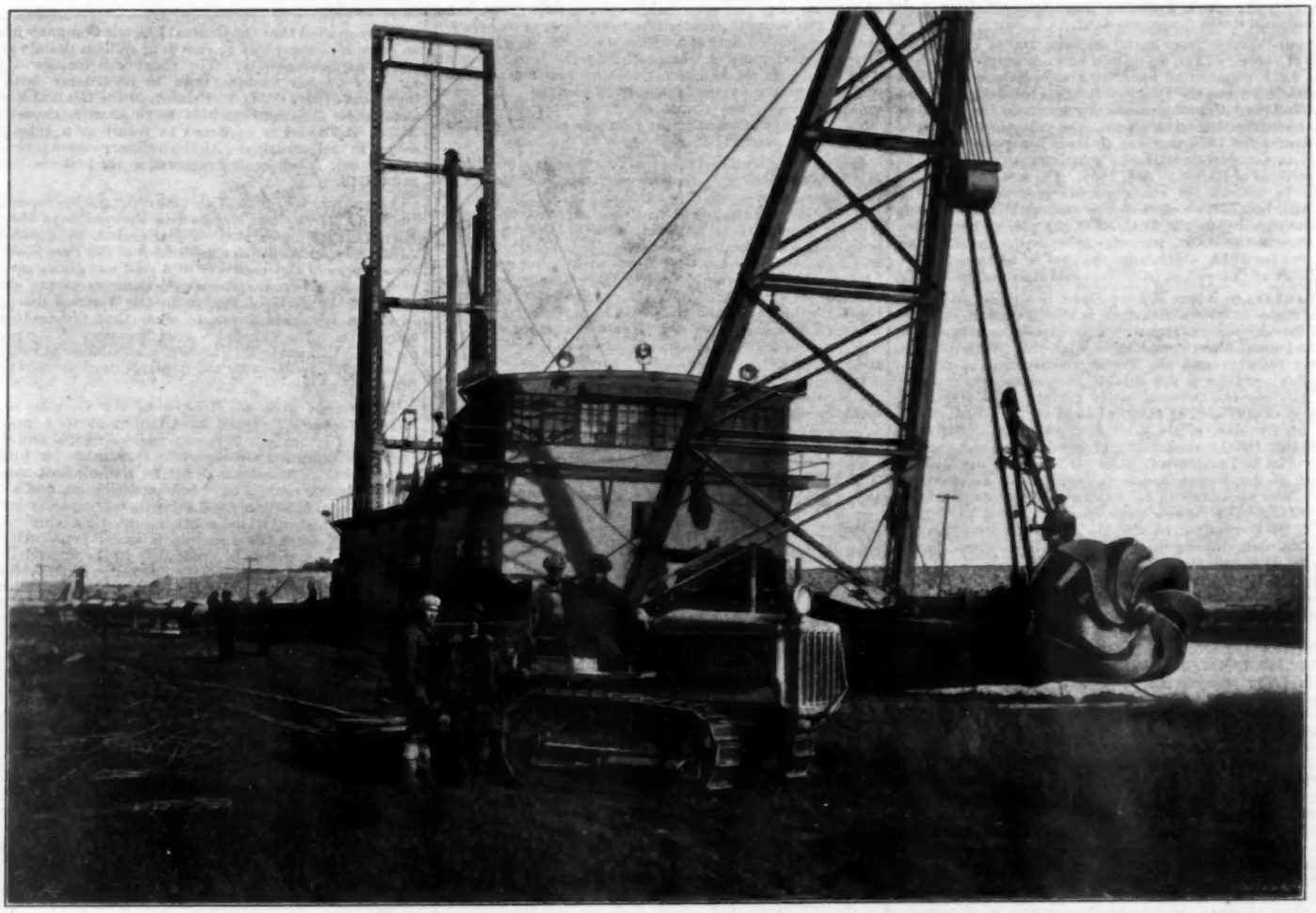
SINCE the initiation by the Royal Automobile Club in November last of a scheme to provide amber-coloured fog discs for attachment to headlights in foggy weather, approximately 200,000 have been issued by the Club. Supplies of the discs, made up in sets of four, are maintained in all R.A.C. road telephone boxes, at the head and provincial offices, and are carried by all the Club's guides. The service was tried originally as an experiment, but it has proved such a complete success that the Club is proposing to maintain it as one of the regular services provided for its members. The discs which are being issued now are of an improved type. They are overprinted with a number of concentric rings to assist in retaining their circular shape should it be necessary to cut them down to fit a lamp, the gumming has been improved to make the discs easier to affix, and a somewhat deeper colour adopted.

26IN. ELECTRIC-HYDRAULIC SUCTION DREDGER ON THE BEAUHARNOIS CANAL

(*For description see page 176.*)



THE DREDGER CUTTING THROUGH THE NEW YORK CENTRAL RAILROAD



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DEATH.

ON February 4th, 1931, at a nursing home in London, after a short illness, JOHN FREDERICK SIMMANCE, of Grosvenor House, Park-lane, and 1, Westminster Palace-gardens, S.W. 1, and joint managing director of Alexander Wright and Co., Ltd.

THE ENGINEER.

VOL. CLI No. 3918

FEBRUARY 13, 1931.

The State of the Navy.

In a speech at Newcastle on Saturday last, the First Lord of the Admiralty dwelt upon the beneficial results to labour and industry of the Government's naval construction programme. This is not by any means the first time that Mr. Alexander has claimed, by implication, credit for his party on account of its supposed solicitude for the welfare of the shipbuilding industry. Two months ago he announced in Parliament that the Admiralty contracts for 1930–31 were to be spread over as wide an area as possible in order to mitigate unemployment As the contracts in question represent a total value of about £9,500,000, the greater portion of which would be spent on labour, their immediate allotment would, undoubtedly, have helped to alleviate the distress which notoriously prevails in every shipbuilding district round our coasts. It was assumed by the public that this work was to be put in hand without delay, nor did the Government do anything to correct the erroneous impression it had created. Only of late has it become known that the 1930–31 naval programme is still held up, and that few, if any, of the vessels for which it provides have been actually ordered. They comprise three light cruisers of the "Leander" class, a flotilla leader and eight destroyers, three submarines, a netlayer, and four sloops. Of these vessels, two cruisers, the leader, the netlayer and all the sloops are to be built in H.M. dockyards, leaving only one cruiser—"Achilles"—eight destroyers, and a submarine for private industry. Apart from other aspects of the matter, the preferential treatment given to the Royal dockyards is resented in shipbuilding circles. It is notorious, not only that construction is more expensive in the dockyards than outside, but that those establishments have been unduly favoured since the war. In spite of sweeping reductions in the strength of the Navy, the dockyard *personnel* has remained at a fairly constant figure in recent years. For this circumstance there is no economic justification. Unfortunately, however, dockyard employees have been encouraged to consider themselves privileged members of the community, for whom jobs must be found, or made, irrespective of the actual requirements of the Navy. The latest development in this policy is the allocation of destroyer construction to the dockyards—a branch of work in which they have had no previous experience, and this at a period when shipyards which have specialised in such work for a generation are clamouring for orders.

Owing to the London Naval Conference being then in session, the Navy Estimates for 1930–31 contained no provision for new ships. Last July, however, the Government introduced the programme referred to above. It was small enough in all conscience, but, even so, its cost appears to have staggered the Treasury, and a sum of little more than £23,000 was set aside for expenditure in the current financial year. This made it impossible for any serious work to be done on the programme during the fiscal year; hence, the delay in placing the contracts. It will be a full six months from now before the shipbuilding trade derives any substantial benefit from this widely advertised programme, so that the First Lord's congratulations to the industry last December were decidedly premature. Meanwhile, the time is approaching for the Navy Estimates for 1930–31 to be laid before Parliament. They are awaited with considerable interest by all those who still believe in the necessity of naval defence. In his rather ambiguous speech at Newcastle, Mr. Alexander said it would be disastrous, while negotiations for the limitation of armaments were "still in being," if this country were "to commence to build ahead." On the other hand, he added, "to suspend the quota scheme would hinder, not help, agreement among the Powers." Up to the present this country has certainly shown no inclination to "build ahead." On the contrary, we are not building anything like the amount of new tonnage that is required to keep the Navy up to Treaty strength. Thirty-one of our 54 existing cruisers will have exceeded their span of effective "life" by 1936, yet, so far, the Government has authorised only four new cruisers, only one of which is on the stocks. We are in full agreement with Mr. Alexander as to the unwisdom of slowing down construction in the vain hope of promoting disarmament. After pursuing this policy for nearly two years, what do we find? Every other Naval Power of importance is busily engaged in warship construction, in most cases on a grand scale. America is building seven 10,000-ton cruisers and a large aircraft-carrier. Italy last year launched over 59,000 tons, and France nearly 40,000 tons, of new warships, and both those Powers have many more fighting craft on the stocks or on order. It may, of course, be merely a coincidence, but it is, nevertheless, a fact that every curtailment in our own naval programme has been swiftly followed by an all-round increase in foreign construction. As the inevitable result of this, our relative strength shows a progressive decline. If the process is to be arrested, we must adopt without delay an adequate scheme of construction extending over a term of several years and embracing cruisers, destroyers, and submarines. The London Naval Treaty involved a serious sacrifice of that naval power upon which the safety and integrity of the British Empire is still admitted to depend. It was, we believe, unwelcome to the nation at large, but was accepted in the interest of peace and on the understanding that the Navy would at any rate be maintained at the standard prescribed in the covenant. That condition, unfortunately, is not being fulfilled. As a concession to America, the British Government agreed to limit its future force of cruisers to 50 ships, or 20 less than the total which the Admiralty had previously regarded as the minimum consistent with bare requirements. We have now rather more than 50 cruisers, and, presumably, shall still have 50 when the next Naval Conference assembles five years hence. But, unless our shipbuilding policy undergoes a prompt and radical change, the British cruiser fleet of 1936 will be, in the main, a collection of antiques, imposing only on paper. If the present rate of construction—averaging two cruisers a year—is adhered to, by 1936 we shall have, at most, ten 6in. gun ships of the

"Leander" class ready for sea, together with the fifteen 8in. gun cruisers already built, yielding a total of twenty-five comparatively modern and effective units. The remaining twenty-five cruisers will belong to the "C" and "D" groups, built during the war and already out of date. These little ships, designed primarily for duty with the Grand Fleet and the Harwich Force, are quite unsuitable for patrol work on the trade routes and were never intended to be used for that purpose. Yet, it is, apparently, proposed to retain them on the active list indefinitely, instead of replacing them by modern vessels at least equal to contemporary foreign cruisers in tonnage, speed and armament. If that, indeed, be the Government's intention, there is, we think, no doubt as to the eventual result. Sooner or later the country will wake up to the gravity of the situation, a "panic" programme will be adopted, and we shall incur both heavy expenditure and foreign distrust in a belated effort to make up for lost time. Our political history for two generations has been marked by a succession of "naval" panics, all arising from the same cause, all producing the same consequences, and, we would add, nearly all proving fatal to the Government of the day. Prolonged neglect of the Navy is a political blunder which invariably brings its own punishment. That is a truth which should be apparent to the most casual student of domestic politics.

The present is a particularly favourable moment for drafting a plan of naval construction in accordance with future requirements. In the first place, those requirements are known, being, in fact, clearly stated in the text of the London Three-Power Treaty; secondly, our national industries stand in urgent need of the help which a building programme of the requisite scope would give them; thirdly, it is essential to make an early start with the task of replacing obsolete material within the framework of the Treaty, since, otherwise, we shall go into the next Naval Conference bereft of bargaining power. While the competitive spirit in armaments cannot be too strongly deprecated, we are equally against the policy of emasculating the British Navy at a time when the combatant fleets of other Powers are being heavily reinforced. On the First Lord's own showing, Great Britain has "proved her goodwill in the matter of naval disarmament more, prehaps, than any other Power in the world. . . . Our naval expenditure has steadily declined; that of others has steadily gone up." We have, in fact, done enough, and more than enough, to prove our good faith. We cannot afford any longer to neglect the Navy, which, whether or no it has ceased to be the first line of defence of Great Britain herself is now, and will long remain, the principal defensive arm of the British Empire as a whole.

Locomotive Feed.

IF the first discussion on Mr. Gresley's paper on "High-pressure Locomotives," which took place on January 23rd, was a little disappointing, the second. which occupied the whole of last Friday's session at the Institution of Mechanical Engineers, and that at Manchester in the preceding week, made up for it. There was hardly one of the speakers who did not throw some light on the broader issues connected with the use of abnormally high pressures in steam locomotives, although, very naturally, the particular type which is represented by "No. 10,000" received especial attention. The feature which distinguishes that engine from others is the employment of a complete water-tube boiler. But the water tube fire-box is common to most designs. It raises at once the problem of incrustation, which may justly be regarded as the only serious disadvantage of the type.

We need not remind our readers that the hardness of normal untreated feed waters is dual in character. It is composed partly of bicarbonates and partly of sulphates, chlorides and nitrates. The carbon dioxide is driven out of the bicarbonates by boiling, reducing them to insoluble carbonates. It is a fairly easy matter so to arrange the feed system in a boiler that these salts are deposited in a loose condition in a position from which they can be removed without difficulty. That is what happens in the Yarrow-Gresley boiler, in which a compartment at the forward end of the steam drum forms a sort of sedimentation chamber. Experience with "No. 10,000," confirming that obtained with thousands of other boilers, has shown that this so-called temporary hardness can be dealt with relatively easily. Unlike the bicarbonates, the sulphates, chlorides and nitrates of calcium and magnesium are not deposited by mere boiling, but every pound of water that is evaporated leaves its quota of these salts behind it, frequently as a hard scale upon the surfaces. As the bulk of the evaporation takes place in the fire-box, it is there that deposits on the tubes are most likely to occur, and it is just there that they are most objectionable, owing to the high temperature of the adjacent fire. If we may assume, as seems probable, that the temporary hardness can be almost entirely separated by the use of appropriate devices, we are without that assurance in connection with permanent hardness, and the fact that Mr. Gresley has found it necessary to introduce special methods of examining the interior of his fire-box tubes and a special tube scaler for cleaning them, shows that he is providing against an occurrence which he cannot prevent as long as he draws his water from sources which contain permanent hardness, and takes no steps to purify it before use. Now, if the high-pressure locomotive is to remain with us—that is to say, if it is shown by experience to be more economical than normal pressure engines—it is essential that the danger of incrusted tubes should be entirely removed. That is not only essential in the interest of safety, but it is desirable in the interests of economy. The only way at present of getting rid of this troublesome occurrence is to treat all unsuitable waters before use, and that method is already being followed on an increasing scale by railway companies. Indeed, we may say that the time is not far distant when a chief mechanical engineer will no more think of permitting impure water to be used in his boilers than a marine engineer or power station engineer would. Unfortunately, the locomotive presents a doubly difficult problem, because it has to use, as Mr. Gresley put it, "a hundred per cent. make up." It is not easy to see how it can ever be fed with distilled water, or, if such water could be provided, how it could be prevented from absorbing air and so introducing another evil for the one it removed. But, by proper attention and the use of proper appliances, the hardness, permanent and temporary, can be almost entirely removed. Such appliances should be employed in all districts in which the water as found is not fit for use. The pick-up troughs present a certain amount of difficulty. Some of the troughs on the Great Western Railway are supplied with treated water, but owing to the fact that the scoop throws out more water than it lifts into the tender, special arrangements for draining the ballast back to the trough are provided. In that respect, there is room for investigation—or, shall we call it, research? The water scoop is very nearly the same to-day as when Ramsbottom introduced it on the London and North-Western Railway in 1860. It is, at least, not inconceivable that a careful study of the design would reveal means of reducing the great amount of waste of water that occurs with it.

In this country there is rarely any difficulty in supplying locomotives with water; it is the quality of the water, not the scarcity of it, that gives anxiety. But in tropical lands it is often difficult to obtain water at all, and in such cases economy of steam is even more important than economy of fuel. In other words, it is not so necessary that the boiler should be efficient as that the engine should be. Available figures seem to indicate that the thermal efficiency of the engine alone may be increased by 20 to 25 per cent. by the use of high pressures, and that, again, owing to the reduction of the quantity of steam, leads, as suggested by one speaker, to the possibility of employing condensers. Experience in that direction has, however, not been altogether encouraging. Even with high efficiency turbine-driven locomotives the condensers are heavy and cumbrous, and the more feasible solution of that overseas problem will be found in the use of internal combustion engines when a thoroughly satisfactory locomotive of that type has been evolved. In the meantime, however, the increase of pressure would reduce the severity of the present difficulties by enabling engines to run greater distances without re-watering. The subject is, therefore, one which should attract the attention of the C.M.E's of India and other relatively waterless countries. But abroad, as at home, the future progress of the high-pressure locomotive would appear to depend in no small measure upon the complete exclusion of all hard feed waters.

The Manufacture of Small Arms Cartridge Cases.—An Apology.

THE Editor is informed that the articles on the Manufacture of Small Arms Cartridge Cases which appeared in recent editions of THE ENGINEER are based on private and confidential documents to which Dr. Adcock had access in the course of a brief term of employment, now terminated, with a British company manufacturing small arms cartridges.

The articles were published without the knowledge or consent of the owners of the copyright in the above-mentioned documents, and an action for an injunction and damages has consequently been brought in the High Court and judgment obtained against Dr. Adcock.

The Editor of THE ENGINEER wishes to express his deep regret at the publication of the articles.

Unemployed and Unemployable.

(Contributed.)

A FACTOR which must be forcing itself with ever-increasing emphasis upon executives in charge of labour is the fact, not only of a vast army of unemployed, but also of an increasing army of unemployable. The problem of finding a man to fill a specific position is no easier than it ever was, in spite of the great numbers of applicants for posts which are advertised. There is still, frequently, an absence of men with just the right training, whilst the proportion who are totally unfitted for the position seems to grow. The alarming feature is that not only are so many unfitted for a skilled or even semi-skilled post, but it is forcibly impressed upon the interviewer that a rapidly increasing number will never be fit for anything but the commonest manual toil. There is nothing surprising in this. It has been foreseen and is simply the inexorable working out of the laws obtaining in industry to-day. For ten years we have been burdened with an immense number of unemployed. Ten years make the difference between a boy and a man. If an individual has had nothing but casual work over a decade—and that the most important decade of his life—if he has done nothing but drift about, a few weeks here, a month or two there, with long spells of deadening idleness in between, it is not surprising that the result is anything but a skilled workman. And this, in many cases, has been the lot of those who present themselves at the employment executive's office. It is easy to condemn. It is easy to judge too harshly the figures quoted below. Doubtless many of those concerned could have done more to help themselves. But the thing which beats the heart out of a youth is the grinding pressure of economic circumstances. Compelled to take anything that offers, the words "choice of a career" have no meaning for them. They just take whatever presents itself for the sake of immediate shillings—the prospect of future pounds does not enter into their vision, if they have a vision.

In one of the heavy engineering districts, six advertisements were inserted in morning and evening papers recently, inviting applications for an improver for the tool-room. Each applicant was carefully questioned and given one or two very simple tests. The question of experience was of primary importance, and an analysis of the past experience of the applicants is contained in Table I.:—

TABLE I.—*Analysis of Past Experience.*

	Per cent.
Having had genuine engineering experience, viz., machine shop, tool-room, milling, turning, drilling work	69
Forging, steel mill work, and other heavy steel trades	14
No engineering experience whatever	17

As will be seen, these figures are very similar to the further group quoted in Table III. Each applicant was asked questions relating to education and also to practical work, and some of the more interesting results are grouped in Table II. The average age of the applicants was eighteen years.

TABLE II.

Question.	Yes. Per cent.	No. Per cent.
Do you understand metric units?	18	82
Have you ever been to evening school?	41	59
Can you read a drawing?	55	45
Can you use a micrometer?	36	64
Can you cut a screw?	14	86

It is certainly astounding to find only 18 per cent. able to use metric units. They are used almost as much as English units during the last two years or so at an elementary school, and it is surely impossible to study engineering books and journals without meeting them frequently. The only conclusion possible is that the majority of youths had never had to use metric units in actual practice, and so had become quite unfamiliar with their manipulation, although it is realised that this explanation is far from adequate. The majority of the 41 per cent. who had attended any evening school whatever, had already left; not more than three or four of the applicants were still in attendance. Quite a number of those who had never been expressed willingness to start. When it was pointed out to them that they

would have a much better chance of obtaining an appointment if they were already attending, they invariably had no comment whatever to make beyond general agreement.

The figures referring to reading a drawing are the result of an actual test of a very simple nature. If the applicant replied to this question in the affirmative, he was handed a simple drawing and asked to indicate whether the end elevation was a view of the near or more distant end. Likewise, in the case of the micrometer. If the youth asserted he could use one, he was handed a micrometer and asked to measure a piece of material. In addition to the questions tabulated, each applicant was handed an ordinary lathe tool, slightly worn, and questioned regarding its condition. The proportion who returned intelligent answers was 52 per cent. The remainder did not seem to understand or were definitely unacquainted with the tool. There is indeed a touch of the pathetic in the 17 per cent. of miscellaneous applicants, for in addition to clerks and warehouse assistants this figure included a grocer, a picture-framer, a bottle-washer, and a lorry driver.

Another advertisement for an operator for a particular group of machines—a job worth £3 to £3 5s.—brought only a single reply. A further group of advertisements for the same position brought only six more answers, and out of all the seven there was only one worthy of consideration. It was not particularly surprising that the writer should have had difficulty in finding just the right type of man. What was positively astounding was that so very few were keen enough to apply. The indication again would seem to point to a large group of men rapidly becoming unemployable. Possibly, in addition, some of those who at one time might have been keen to tackle the job, are losing heart under the stress of adverse circumstances.

On another occasion an advertisement for a turner brought forty-one applications. When analysed on the basis of experience the results shown in Table III. were obtained :—

TABLE III.—*Analysis of Past Experience.*

	Per cent.
Having had lathe experience	61
Heavy steel trade experience, such as steel mills, &c.	34
Miscellaneous	5

A similar test to the one detailed above, varied somewhat to suit the different job, yielded the following comparable results :—

TABLE IV.

Question.	Yes. Per cent.	No. Per cent.
Do you understand metric units ? ..	15	85
Have you been to evening school ? ..	26	74
Can you read a drawing ?	57	43
Can you use a micrometer ?	54	46

It will be noted there is a great similarity between these figures and those already quoted in Table II. The questions on lathe tools were rather more detailed in this case, and gave the following results :—

	Per cent.
Showing fairly good understanding	33
Hazy idea	18
No idea	49

It is surely unnecessary to comment on the fact that nearly half of those applying for this job, either did not know what a lathe tool was or were unable to make any comment on its use or condition.

An Engineering Question.

By W. M. BOCQUET.

As civilisation progresses and the organisation of any particular state becomes more complex, there is inevitably a tendency to more clearly defined specialisation.

The present age is one chiefly characterised by the development of machinery, enabling as it does each human being to extend by the aid of appliances the sphere of his interest and of his influence.

With so enormous and swift a production of new machinery, it will be evident that all connected with engineering must be subject—perhaps in a greater degree than those involved in other human activities—to the forces which result in limiting and defining.

This specialising is perhaps most noticeable in the branch of engineering which has been up to the present roughly classed as "mechanical."

Until quite recent times, the terms "civil" and "mechanical" covered almost the whole profession, and any one trained in either class was prepared—and generally able—to carry out work of quite extraordinary variety, provided, that is, it could be placed in his particular category.

Very soon, however, it was discovered that specialisation within these two groups was absolutely necessary in order that an engineer might be reasonably well instructed and familiar with the technical details of his profession. The application and extension of electricity and chemistry to all branches of the "mechanical," the swift development of the automobile, the evolution of the airship and aeroplane, not to mention a dozen other important offshoots, each of which required from its experts not only a knowledge of general engineering principles, but a detailed knowledge of particular practice, has compelled a specialisation, the boundaries of which are yearly becoming more clearly marked.

All this, it may be interjected, is perfectly natural, as the different divisions have occurred in a measure along lines which appear quite normal, and were to be expected in the ordinary growth of complexity.

It must be agreed that to a great extent this growth and partition have been harmonious, and the separations have, in consequence, permitted more effective concentration upon particular problems.

Together with this detailed specialisation, the dividing lines between the parts of which may perhaps be left to form naturally, without artificial restraint and with as little as possible interference applied externally, there have grown up certain classes or groups of engineers whose influence is far-reaching and whose functions it may be worth our while to consider most carefully at the present time, whilst the spheres of their activities are still to some extent in course of consolidation. Adjustments may be possible now, which would be difficult later when the normal regularity of set customs may develop a disinclination to change. This refers in particular to that large and influential class whose activities cover that of consulting and inspecting.

At this point it may be permitted perhaps to revert for a few moments to a reconsideration of some of the primary stages in the evolution of our profession.

In the early days of engineering, the inventor, the manufacturer, and the user were one and the same man. This period naturally did not last long. The first division separated the inventor from the other two.

The man who wished to use a new machine and apply it in his business had to make it himself. He therefore copied or modified—and improved upon, perhaps—some machine that had already been tested and tried by others, and left the inventor to continue further researches alone. Incidentally, it may be observed that ever since that first division, inventors have moved like wandering comets in an otherwise well-organised system, where most of the orbits are somewhat less excentric.

The second division was soon in evidence. Men who were clever in making machinery spent their time in this way as manufacturers, and those wishing to make use of it found it more profitable to purchase it complete than to maintain foundries and workshops for its manufacture. This, of course, is the normal position to-day, and the ordinary working of supply and demand, providing the stimulus of competition, maintains a fairly healthy vitality. In a few situations, no doubt, the makers, perhaps by special skill or particular knowledge, have controlled the market by a temporary monopoly. In this case the user has had to accept what was offered or has done without. In the ordinary way a user can pick and choose from a number of manufacturers, and so by his favour influence the development of machines in conformity with his requirements.

As machinery and engineering schemes generally grew more and more complex, and expenditure more lavish, it became increasingly evident that there was room for another class of engineers who were neither makers nor users.

In the growth of our export trade, and more particularly in our colonial expansion, a body of engineers was needed as intermediary between the makers and those responsible for expenditure; men whose special experience in the particular branch of engineering, together with commercial integrity, would ensure satisfactory execution of contracts; contracts in which the price had been reduced to a minimum by the keen competition of public tenders. In this category we now have our consulting and inspecting engineers.

Having in our minds now the position in which the consulting engineer is placed, it may not be amiss to consider his various duties.

Obviously, his primary loyalty is to those who pay for his services. As this is, in almost all cases, the user of the final product, or, in any case, those who are providing the capital for the user, the first duty of the consulting engineer must be to see that the execution of the contract is favourable to the purchaser.

Having assured himself in this respect and satisfied his conscience and his professional instincts, it remains for him to consider his duty to the whole engineering community.

The satisfaction that he gives to his employer will, normally, be reflected in the success he achieves in his profession, and his efficiency or otherwise in this matter may be left to the control of the ordinary forces of supply and demand.

It is, however, in the less clearly defined relations of the consulting engineer to other branches of the same profession—that of engineering in general—in which we may, I think, usefully consider his direct or indirect influence.

As we have already reminded ourselves the first duty of the consulting engineer is to give satisfaction to his employer.

He will draw up a specification, therefore, indicating the quality of the materials to be used and the manner in which the work is to be executed.

It is in this matter—the drawing up of the specification—that it would appear to be advisable for the consulting engineer to consider most carefully not merely the primary end in view—already defined—nor, subsequent to this, merely the secondary one, that is the security of his own reputation; but a third and equally important aspect of the case—one which, being less personal, is more easily overlooked—the effect that his specifications may have on contemporary development in the engineering world in general, either to help or to hinder progress.

In drawing up a specification, the consulting engineer is obviously in a very privileged position. Representing, as he does, the man who pays the piper, it is only natural that he should consider himself entitled to select the tune.

If, therefore, the interests of the purchaser or the contractor are at all in conflict, the specification drawn up by the consulting engineer will, in the natural course of things, be inclined to favour the purchaser—or, at least, attempt to protect his interests, present and future, in every permissible way.

As has already been pointed out, the consulting engineer will first consider his clients' satisfaction and, second, the security of his own reputation and, in consequence, the whole pressure of his control upon the manufacturer will be against the taking of any risks, and will always incline towards the application of the policy of "Safety First."

Now, although the community, as a whole, may, on occasion, be wisely reminded of the utility of this advice in encouraging the preservation of life, to permit its deterrent influence to creep into all our social and industrial activities, would lead, first of all, to inertia and, subsequently, to atrophy of all functions.

It may be as well to consider in what way an attitude of mind—in itself no other than reasonably discreet—may so influence the preparation of specifications as to hinder engineering expansion treated as a national matter.

Let us take a concrete instance. A consulting engineer having been entrusted, we will say, with the technical details in the matter of a large purchase of steel, draws up a specification in order to ensure that the purchaser procures a quality suitable for his purpose.

We will assume that the consulting engineer has learnt—possibly, from his own practical experience in earlier years when associated with manufacturers, possibly from the reports of other users, or even from his own sad adventures in the past through being directly responsible or partly involved in the blame for unfortunate failures—has learnt, one repeats, that steel made by the "open-hearth acid" process is more reliable than that made by the "Bessemer basic."

Into the merits or demerits of either process we need not at the moment extend our inquiry; for the purpose of our analysis it may be assumed that the consulting engineer prefers one method to the other. Now, what is the line of least resistance for that engineer. He will specify—and there are many who will, perhaps, agree, that he is entitled to specify—that the steel must be made by the open-hearth acid process, or, alternatively, he may prefer to state that the steel must not be made by the Bessemer basic process. It is this very question, the extent to which a consulting engineer is justified in dealing with what is primarily a manufacturing problem, that it might be worth our while to direct our special attention.

To elucidate the matter still further let us illustrate it with a fictitious instance. We will suppose that the steel ordered by the purchaser is required in the form of rails. The firms which are prepared to tender having studied the specification, find that the process of manufacture is limited, say, to the open-hearth acid process. Those, of course, which have concentrated upon this process quote, and all others—no matter whether the steel they make is better or worse as steel—are definitely excluded.

Now, the crux of the problem is, Does the purchaser want rails as rails—that is, good rails—with all their special characteristics, or does he want something with a special label which he is told will have all the qualities of good rails? Here it may be argued that this is an academic distinction which need not distract the attention of the engineer who is guided by common sense; nevertheless, it may be well for us to glance occasionally at fundamentals in order to check the alignment of subsequent building.

The point that it would seem to be worth bringing into focus is that the purchaser requires rails, and rails alone. In other words, crudely put, strips of some material, which it will be difficult to break, of a certain particular form, and of such a quality that, so far as he is concerned, they shall last for ever.

If, now, the consulting engineer introduces into his specification anything that is not directly connected with the checking of the characteristics detailed above, he is, to all intents and purposes, trespassing beyond his province, and is, in consequence, interfering with the rights of others; in this case, the freedom of the manufacturer to manufacture in any way he likes, provided only the article he produces serves the purpose for which it is intended.

The answer from the side of the consulting engineer will no doubt be that his specification ensures the very things that are so desirable. To this we can assent, but we must add the qualifying demurrer that although the result is satisfactory, so far as each individual case is concerned, the means employed are

sometimes open to question, and the end gained does not entirely justify their use.

Looking at the subject broadly, it would seem therefore that the duty of the consulting engineer is limited to employing any *tests* that he may consider effective or necessary in checking the quality of the finished article, but that he is not entitled to interfere in any way with the *processes* of production.

We know, of course, that in the application of this broad principle the give and take of industrial co-operation will permit a certain latitude to each of the parties involved. Provided that each recognises with a sense of proportion the bounds suggested by an instinct for justice, co-operation between all concerned might be maintained in the future even more harmoniously than has been the normal experience in the past.

Before concluding this somewhat superficial survey it may not be out of place to try to answer some of the queries that will occur to the inquiring mind.

If this particular portion of the industrial machine has been working fairly satisfactorily, why make any alterations on the score of abstract justice? The answer to this is that alterations carried out in the present may in the future permit the machine to function even more satisfactorily than in the past. Greater freedom to the manufacturer gives more opportunity to make improvements and to introduce new processes; gives more scope to the chemist, the metallurgist, and the inventor.

If the consulting engineer relaxes his specification in the direction of permitting *any* methods of manufacture, how is he to retain his feeling of confidence that the quality of the product is not deteriorating?

Obviously, the answer to this is that if he has reason to doubt the quality he must increase the number of his tests; until, in fact, his instincts are satisfied in this respect. If tensile tests are insufficient, then let there be added "Izod," "Brinell," or any other means that lend themselves to the purpose. If wearing quality is to be checked, then, instead of a detailed analysis of composition, let abrasion tests be added.

In a few years what appears now, no doubt, to be an added complication and expense, will be reduced to a simple and effective routine.

Others may remark, But the manufacturers themselves are perfectly satisfied. They would not thank you for these suggestions. That is so. The primary urge behind the modern large manufacturing companies is the necessity, no matter what else may be produced, of producing dividends. All other interests must necessarily be subsidiary. If, therefore, orders are coming in with reasonable regularity, and the plant at present installed is functioning well, obviously no changes are desired nor welcomed. It is recognised that modifications such as those suggested would be opposed in all probability by some of the well-established businesses. But the change, through permitting experiments in the employment of new processes, thereby extending the field of open competition and ultimately lowering the costs of production, though resisted at first by some, would, it is believed, be appreciated by all in the course of time.

International competition becomes keener each year, and it would seem advisable for us to consider most carefully any obstacle that may be hindering our manufacturers from maintaining that reputation for industrial initiative which was so commendable a virtue of our predecessors.

Obituary.

SIR CHARLES ALGERNON PARSONS.
SIR ARTHUR DORMAN.

As we go to press we learn with regret of the deaths of The Hon. Sir C. A. Parsons and Sir A. Dorman.

Sir Charles left England on January 22nd on the "Duchess of Richmond" for a cruise to the West Indies. He died on board on Wednesday evening, February 11th, and we understand that his body has been put ashore at Kingston, Jamaica, and will be sent home by another steamer. Sir Charles, who was in his seventy-seventh year, was a younger son of the third Earl of Rosse. He was educated privately and at St. John's College, Cambridge, and was the founder of C. A. Parsons, Ltd., of Heaton Works, Newcastle-upon-Tyne, and the Parsons Marine Steam Turbine Company, Ltd., of Wallsend-on-Tyne. In the opinion of many people, Sir Charles was the greatest inventor and engineer of our times, and we shall deal fully with his many-sided work in our next issue.

Sir Arthur Dorman died at his home, Grey Towers, Nunthorpe, near Middlesbrough, on Wednesday, in his eighty-third year. He was born at Ashford in Kent, and after spending some time at Christ's Hospital and in France, he went to the North of England and was apprenticed to the iron-making firm of Richardson, Johnson and Co., of South Stockton. In 1876 he entered into partnership with the late Albert de Lande Long, and founded the firm of Dorman, Long and Co., acquiring the West Marsh and Britannia Ironworks, at which the manufacture of rolled joists and sections was begun. In 1899 Dorman, Long and Co., Ltd., amalgamated with Bell Brothers, Ltd.

We shall deal fully with the work of these two great engineers in our next issue.

20,000 kVA Water Wheel Alternators.

Two large water wheel alternators forming the initial generating plant of the Waikaremoana hydro-electric power station of New Zealand, have been constructed and installed in that station by the Metropolitan-Vickers Electrical Co., Ltd. The power station is one of three designed to be the main generating centres of the North Island scheme, the others being at Mangahao, near Wellington, and at Arapuni, near Auckland. The Mangahao station, which is equipped with five sets of Boving water turbines and Metropolitan-Vickers alternators with an aggregate capacity of 24,000 kVA, has been in full service for some years; but the construction of the Arapuni station has been delayed by unexpected difficulties and is not yet in commission. The Waikaremoana station, which was put into commission last year, is situated on the eastern side of the island, about 50 miles from Gisborne, and is designed for an ultimate plant capacity of 120,000 kW and to be connected by 110,000-volt transmission lines with the Mangahao and Arapuni power stations, situated at distances of 220 miles and 185 miles

FIG. 1—ROTOR BODY

respectively. In order to facilitate the transmission of large amounts of power over such great distances four Metropolitan-Vickers synchronous condensers have been installed on the transmission system, including a 10,000-kVA machine at Khandallah, near Wellington, a considerable amount of power from the Waikaremoana power station being initially required to supplement the supply in the Wellington area. The water supply for the Waikaremoana power station is taken from Lake Kaitawa, which is fed by the Waikaretahite River from Lake Waikaremoana, the net head of water being from 631ft. to 645ft. As shown in Figs. 5 and 6, the two generating sets under consideration are of the horizontal type, incorporating Francis reaction type water turbines constructed by Sir W. G. Armstrong, Whitworth and Co., Ltd., and a feature of interest is that the turbine rotor is overhung on an extension of the alternator shaft, a specially large bearing being provided on the coupling side of the alternator to carry the increased weight. Another feature is that, while each generator has its own direct-coupled exciter, either machine can be fed alternatively from either of two separately driven exciter sets, which sets were installed by the Metropolitan-Vickers Electrical Company in 1921, mainly for supplying the power required for the building operations. Each set consists of a Francis type water turbine, an A.C. motor and a D.C. generator, the generator being driven either by the water turbine or by the A.C. motor, as required.

The normal rating of the alternators is 20,000 kVA at 0·8 power factor, i.e., 16,000 kW, and since they are designed to B.E.S.A. Specification No. 169, which provides for an overload capacity of 25 per cent. for two hours, they have a two-hour rating of 25,000 kVA. Normally they are driven at 428 r.p.m., but are designed for an overspeed of 85 per cent., i.e., a maximum safe speed of 792 r.p.m. The current is generated at 11,000 volts and each generator feeds through its own bank of step-up transformers on to the 110,000-volt bus-bars, but provision is made for paralleling on the 11,000-volt side. Each alternator complete with its exciter, bearings, pedestals, and sole plates weighs 133 tons. The stator of each machine weighs 40 tons

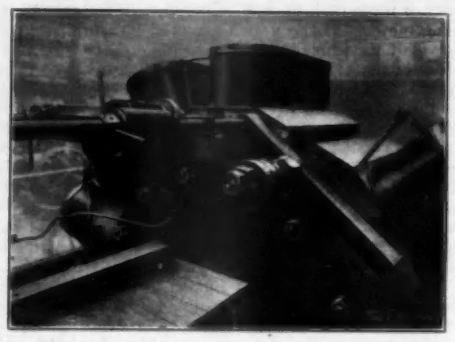


FIG. 3—PRESSING POLES IN MAGNET FRAME

and the weight of the rotor complete with its shaft and exciter is 76 tons. The overall diameter of the machines is 17ft., whilst the rotor diameter is 10ft. 6in. On account of railway loading gauge limitations each stator had to be built in two parts, the division being made horizontally, as shown in Fig. 7. The frame is of cast iron and weighs approximately 15 tons. Each half was cast in one piece and the two parts bolted together, fitted bolts being used to ensure exact location. With the exception of the portions forming the main air outlets at the top and bottom, where the hot air is discharged either upward into the engine-room or downward into a duct provided in the

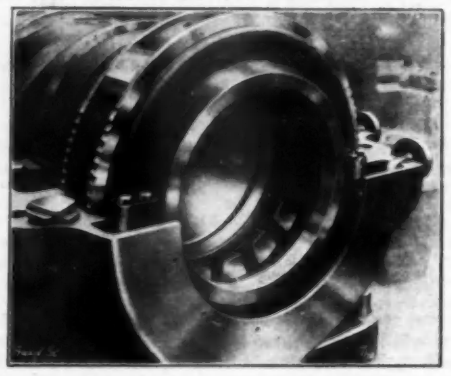


FIG. 4—MAIN BEARING SHOWING THRUST PADS

foundations—which is the normal arrangement—the frame is closed on the outside.

The core, which is shown assembled in the frame in Fig. 8, is built up of segmental stampings of high-grade electrical sheet steel, and is secured to the frame by two dovetailed projections on each segment formed on the outer edges of the stampings and fitting closely in dovetailed slots which are machined out of axial ribs in the frame. On either side of the frame joints, however, half segments with only one dovetail are used, and in order to prevent these segments from moving, additional plain ribs are provided in the frame, as shown in Fig. 8. The core is clamped by axial bolts between segmental cast iron end plates and the core teeth are supported by radial metallic fingers. To ensure close contact of the core joint of the two parts of the stator, the abutting faces of the core were accurately finished and the core and frame so propor.

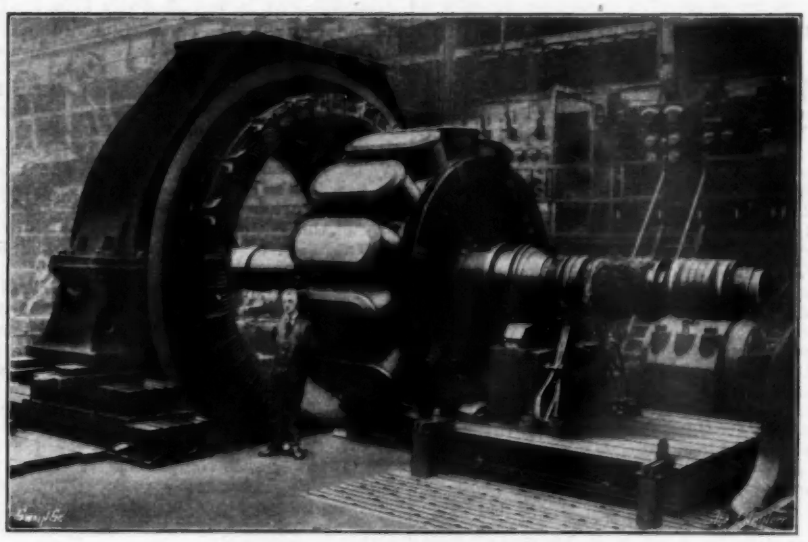


FIG. 2—THE MACHINE BEING ERECTED AT MAKERS' WORKS

tioned that the faces of the core meet before those of the frame, with the result that the core joint receives the main bolting pressure. The stator complete with its winding is shown in Fig. 9, the winding being of the two-layer diamond coil type, which is the standard winding used by the makers. The coils are formed completely insulated and tested before they are placed in the open type slots. All coils of the winding are identical and each coil consists of a single turn, so that there are two conductors per slot, each conductor consisting of twelve strips in parallel. The coils are formed by winding twelve turns of the strip round two pins, so as to form a long loop, which is then pulled out laterally into diamond shape and cut open at one end. After forming, the individual strands are separated, wrapped with mica silk tape, re-assembled, and pressed together. The straight sides of the coil are then insulated with a micanite cell wrapped and hot-ironed by the Haefely process, whilst the coil ends are insulated by layers of varnished cotton tape, the layers being bor ded with insulating enamel. After placing the coils in the slots and securing them with hornbeam wedges, the joints between adjacent coil ends are made by means of soldered clips, each joint being made in two separate clips of six strips in each. The two sections so formed are separately insulated throughout the entire winding and are transposed at the middle of each phase, thus eliminating circulating currents between them. The bend at the rear end of the coil causes the strips to lie in opposite order in the two sides of coil, thus reducing circulating currents within the sections to a very small value. Owing to the thinness of the individual strips eddy currents in them are negligible. Each coil is secured against short circuit forces by cording it at each end to an insulated steel ring which is carried on angle brackets bolted to the core end plates, whilst peripheral movement is prevented by impregnated hardwood blocks driven between adjacent coils so as to form three complete circles at each end, an operation that is carried out while the winding is heated for drying. All the special connections are rigidly secured by bronze clamps and the whole winding is finished with waterproof enamel.

On account of the high speed for which the sets are designed—the guaranteed maximum safe speed is 792 r.p.m.—the magnet wheels—see Fig. 1—are of a composite construction of rolled steel plates instead of the usual construction of cast steel. Each wheel, weighing 37 tons, consists of eight plates of 5in. thick, spigoted and bolted together by fourteen fitted bolts, and is pressed hydraulically on to its shaft. On the outside of the magnet wheel fourteen flat faces are machined to form seatings for the poles and field coils, and fourteen dovetailed slots are planed out and accurately finished by milling to receive the pole dovetails, having a special profile which has been adopted by the Metropolitan-Vickers Electrical Company as standard. The poles are built up of heavy gauge stampings of high-tensile rolled steel plate, clamped between end plates of semi-circular section by means of a number of through bolts. At the outer ends the stampings and end plates have projections forming projecting pole tips which support the field coils over their entire periphery. At the inner ends both stampings and end plates are shaped to form the pole dovetail. The pole dovetail is finished to a press fit in the corresponding slots of the magnet wheel and the poles with the field coils are pressed hydraulically into position, no wedges or keys being required. The illustration Fig. 3 shows this operation being carried out with the portable press equipment which is supplied by the makers for this purpose and also for dismantling. The field coils are composed of strap wound on edge, as adopted as standard by the makers for all high-speed generators, and the turns are insulated with a double layer of treated asbestos, and while electrically heated each coil is pressed with a load exceeding the centrifugal force at the runaway speed. The ends and inside are insulated with flexible micanite and the coil is mounted on a rigid steel spool. Finally the spool ends are machined to the correct overall dimensions to ensure firm clamping of the coil between the pole tip and the rotor body when the poles are pressed into the magnet wheel. Lateral distortion of the field coils at over-speed is prevented by V-shaped bronze clamps bolted to the magnet wheel between each pair of poles.

The forged steel shaft, which weighs 12 tons and is 23ft. long, is extended beyond the bearing on the turbine side to carry the overhung runner of the turbine, and at this end, the shaft has a solid forged flange, to which the turbine runner is spigoted and bolted, the driving torque being carried by twelve fitted bolts of 3¼in. diameter. The rotating part of the set, which weighs 76 tons in all, is carried on the two alternator bearings alone. The bearing on the turbine side, which carries the greater part of this weight and also takes the axial thrust of the turbine, is of particular interest. It is 20in. in diameter, the shaft journal being of increased diameter to carry the heavy bending stress, and it is 40in. long. To take the axial thrust, which amounts to 20 tons towards the alternator at full load, but which may be reversed in direction under certain conditions of loading, a solid forged flange is provided on the shaft and a double set of Michell white-metalled thrust pads is incorporated in the bearing. Fig. 4 shows the arrangement, part of one set of thrust pads being seen in place and a single pad being laid out on the left. The pedestal which carries this bearing weighs 6 tons. The bearing pedestals, and also the stator feet, are carried on cast iron sole plates. The pedestal sole plate at the turbine end is extended and bolted to the turbine casing; the sole plate at the other end is extended to carry the exciter.

Lubrication is provided by a low-pressure oil supply. Oil is circulated by duplicate motor driven centrifugal pumps which draw the oil through strainers from a sump and force it through two water coolers to the main bearings and separately to the thrust bearing, the overflow returning direct to the sump. The main bearings are also provided with ring lubrication as a safeguard in the event of any failure of the pressure supply. Temperature indicators on both the main bearings and the thrust bearing are provided, with contacts which operate an alarm signal in the event of excessive temperature.

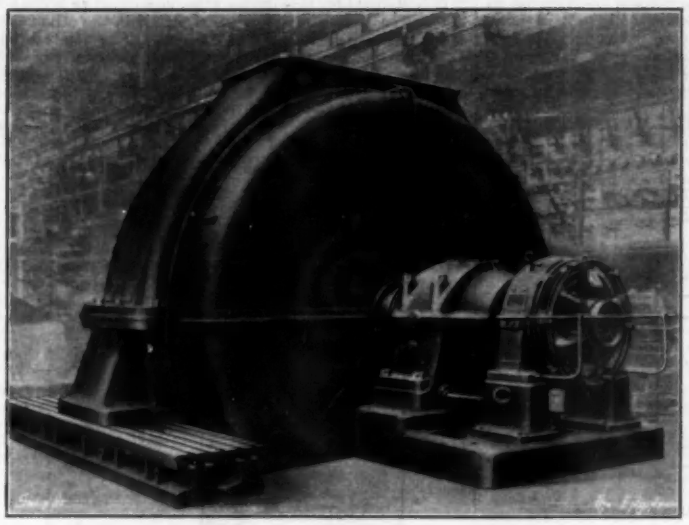


FIG. 5—THE COMPLETE 20,000-kVA ALTERNATOR

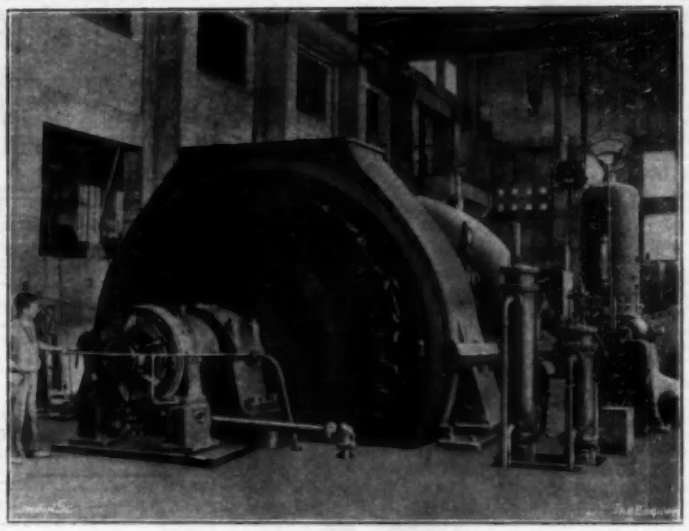
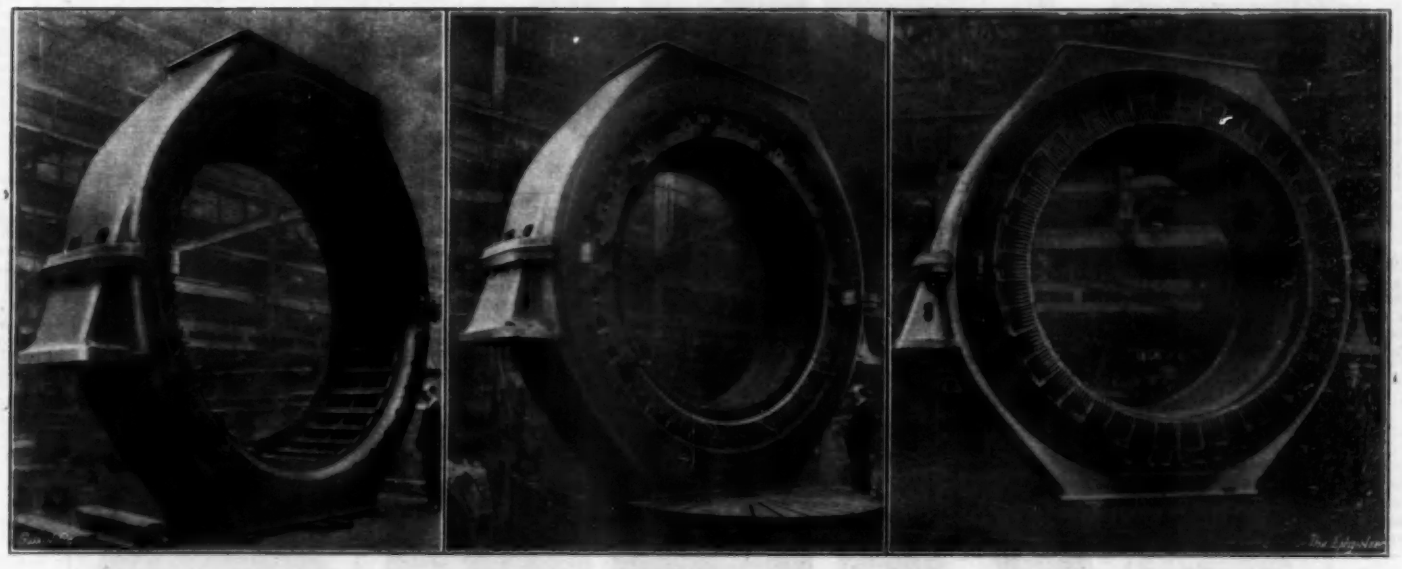


FIG. 6—THE ALTERNATOR BEING ERECTED AT SITE

The illustration Fig. 2 shows one of the machines being assembled on the test bed in the maker's works. The rotor was first placed at the side of the pit in the position shown and the stator lifted over the driving end of the shaft and placed on temporary supports to allow the rotor to be carried into it. The rotor was then slightly lifted, thereby raising with the stator a total load of 115 tons, while the temporary supports were removed, after which the stator was lowered on to its sole plates and the rotor into its bearings. In the erection of the machines on site, where adequate lifting equipment for this operation was not available, the alternative method was adopted of lifting the rotor into position in the lower half of the stator and then lowering the top half of the stator over it, two poles being temporarily left off the rotor to allow of the assembly of the coils which bridge the stator joints.



FIGS. 7 TO 9—THE STATOR AT VARIOUS STAGES OF CONSTRUCTION

Complete tests were carried out on both alternators at the works. The mechanical safety of the rotors was tested by running each rotor at approximately the speed which would occur if the load were suddenly removed from the set—a speed calculated at 792 r.p.m. This test, requiring a driving power of 1100 kW, was carried out in the company's overspeed test house. The overspeed test was repeated on site by running the set on no load with full gate opening. In this test the actual overspeed reached proved to be somewhat lower than that used in the works tests. Sudden short-circuit tests at full voltage were also carried out on site, with satisfactory results. For estimating the efficiency in the works tests the separate losses on open and short circuits were measured by the electrical

input to a D.C. motor driving the alternator. A heating test equivalent to full-load conditions was made by a modification of Hobart's method—the actual test conditions in this case consisting of alternate half-hours' running on open circuit at 31 per cent. over-voltage and on short circuit at 42 per cent. over-current. It is of interest to add, in conclusion, that subsequent extensions to the company's testing equipment have made it possible to test machines of twice the capacity of these alternators on full kVA load.

The Moynan Steam Dryer.

THE steam dryer which we illustrate herewith in two different forms has been designed and is being manufactured by Mr. F. K. O. Moynan, of Sutton Bonington,

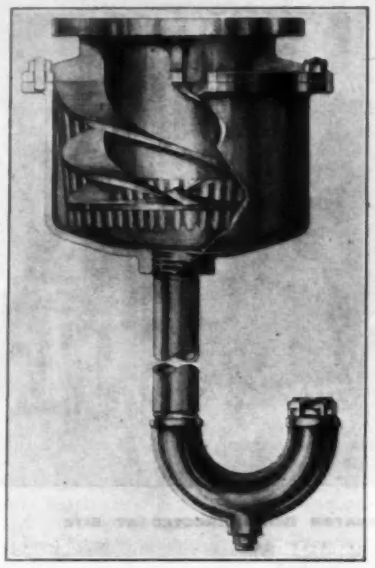


FIG. 1—LOW-PRESSURE "EJECTIFIER"

near Loughborough. It is known as the "Ejectifier," and is, we are informed, in use at the Barking, Stourport, and other large power stations and elsewhere, in conjunction with boilers of various types. It can be arranged to deal with flows of steam of widely different amounts and at various pressures. Equipments capable of drying

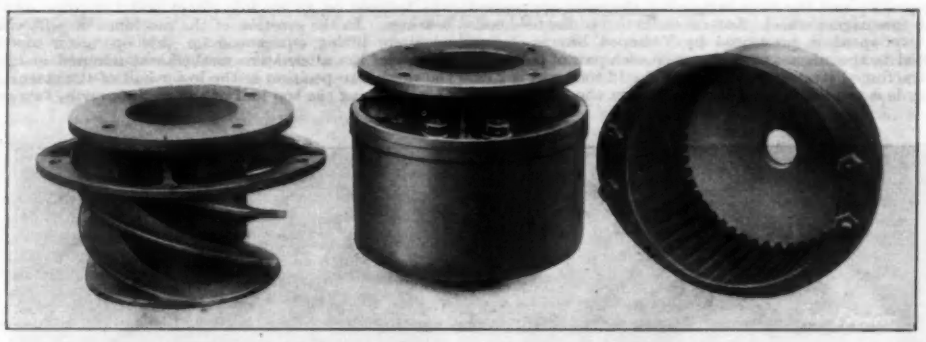


FIG. 2—LOW-PRESSURE DRYER, ASSEMBLED AND SEPARATED

360,000 lb. of steam per hour have been produced and installed. These equipments are stated to be the largest steam dryers—from the standpoint of capacity—that have been designed for a single boiler drum in this country or abroad.

The low-pressure type of dryer is illustrated in Figs. 1 and 2. It consists of but two parts, both of which are made of cast iron. The central portion is a short flanged pipe surrounded, just below the flange, by a collar plate, which is united to the pipe by four arms. The spaces between the arms form ports through which the steam passes into the dryer. Starting from each arm a spiral vane winds round the pipe. These vanes extend a short distance below the foot of the pipe and are united at their ends to a circular bottom plate, which is dished upwards. All these parts, it will be understood, constitute a single casting. The second portion of the dryer is an inverted bell cover which fits closely over the spiral vanes, and which is bolted to the ported collar plate of the central portion. The interior of this cover is ribbed. The ribs are vertical and increase in height towards the bottom of the cover. The cover extends below the dished plate at the foot of the spiral vanes and forms a sump.

As shown in Fig. 4, one or more of these dryers may be connected by the top flange of the inner portion to a manifold which, in turn, is connected to the boiler shell plate beneath the steam outlet. The steam enters the dryer by way of the ports in the collar plate, and passing downwards between the spiral vanes reaches the lower end of the pipe portion of the inner part, up which it ascends into the manifold, and thence into the steam outlet pipe of the boiler. In passing downwards over the vanes, the steam is dried and purified by the centrifugal ejection of its moisture and dirt against the ribbed walls of the cover.

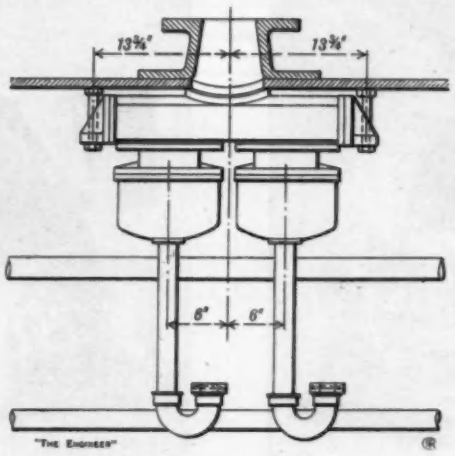


FIG. 4—MULTIPLE UNIT DRYER

The moisture and dirt descend into the sump, where their re-entrainment with the steam is prevented by the presence of the dished botton plate attached to the ends of the spiral vanes. The sump is drained through a pipe fitted at its up-turned end with a non-return valve made of "tungum," a new non-corrodible non-ferrous alloy. Alternatively, the moisture and dirt, instead of being returned to the boiler, may be drained away externally.

The number of dryers attached to the manifold varies with the quantity of steam to be treated, and its pressure. As a general guide, each dryer may be taken as capable of dealing with 20,000 lb. of steam per hour when the pressure is 200 lb., and 60,000 lb. of steam per hour when the pressure is 600 lb. At these rates the velocity of the steam through the dryer is stated to be about 6000ft. per minute. The pressure drop across the dryer is claimed not to exceed 9in. of water.

The design illustrated in Figs. 3 and 5 is a recent improvement, which has been produced to meet the requirements imposed by the increase of steam pressure now being widely adopted. In this design the central pipe portion has eight ports in the collar plate and eight spiral vanes to correspond with them. The vanes end just short of the foot of the pipe, instead of below it, and the pipe bore is flared as shown in Fig. 5 to form a *vena contracta*. The bottom plate is a separate casting, which is bolted to the bottom of the cover. It is formed with a pronounced upward cone, the apex of which enters the lower end of the central pipe, and round its periphery it is grooved to catch any moisture that may be carried on to it and to lead such moisture over the edge into the sump. The outer cover is in two parts, the base being detachable from the wall portion, and the wall portion is formed internally with inclined ribs having a saw tooth section. This modification is claimed to ensure a better pick-up of the separated moisture and to prevent splashing consequent upon the impingement of the water against the walls at a high velocity.

Both the high and the low-pressure types may be fitted for internal drainage of the sump, as illustrated in our engravings, or for external blowing off, or, if desired, with both systems of removing the moisture and dirt. If external blowing off is desired, the dryers are fitted with an extra deep sump in order to increase the intervals between the blowing-off periods.

It is claimed for this device that, consisting as it does of but two castings in one form and of four in the other, it is simple and easily installed. There are, it is pointed out, no welded or bolted pieces in the apparatus, which if they became detached might find their way into the steam range and result in serious damage. The steam spaces inside the dryer are, it is emphasised, sufficiently ample to avoid the risk of their becoming choked. When internal

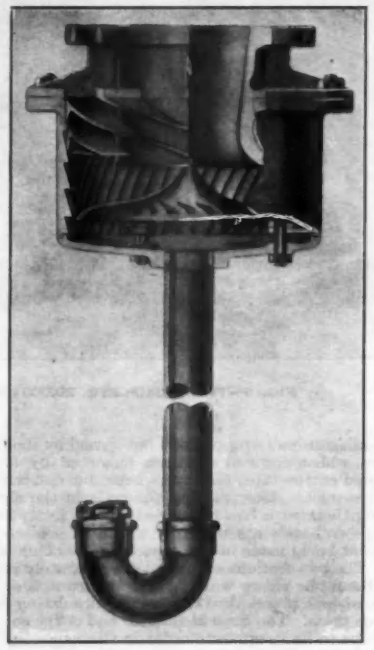


FIG. 5—HIGH-PRESSURE "EJECTIFIER"

drainage of the sump is adopted, the design of non-return valve adopted is claimed to be such that it will operate under a head of less than 1in. of water, and that it will not stick. Flooding of the sump is thereby rendered impossible. Since the apparatus is entirely internal to the boiler, no part of it is under pressure conditions. Finally, the small size of the individual sections enables a dryer of large capacity to be assembled inside a drum provided with a manhole of ordinary size.

FIG. 3—HIGH-PRESSURE DRYER IN PARTS AND ASSEMBLED

IN some parts of the Hetch Hetchy 28-mile aqueduct tunnel, which is being driven through the Coast Range to supply San Francisco with water, gunite has been used for lining. Because of the possibility of ground movement within a short time after the removal of the timbers, it was necessary that the gunite should acquire high early strength. A high-alumina cement was first tried, but the thickness of the gunite resulted in excessive heating, which so seriously impaired the strength that a change was required. The present provision for early strength consists, according to the *Engineering News-Record*, of dosing the mixing water with calcium chloride equal to 3 per cent. of the weight of the cement. This admixture, although producing some heating, has proved satisfactory. Its use results in securing some strength in a few hours and about 60 per cent. of twenty-eight-day strength in four days. The proportions of the gunite are ten sacks of cement per cubic yard of dry mix. This mix tests about 6000 lb. in twenty-eight days.

Canadian Engineering News.

Canada and Refined Copper Exports.

A RECENT proposal in Washington that a duty be levied on refined copper brings out the fact that Canada will shortly be producing more of that metal than she requires for her own use. For many years the Dominion brought practically all its refined copper in from the United States. One of the complaints often made was that blister copper from Canadian mines went to the United States, where it was refined and returned in a much more expensive state. Until very recently, comparatively little copper was refined in the Dominion, but with a new plant at Copper Cliff, Ontario, which opened last July, and the one erected by the Noranda and other interests in Quebec, the Dominion will be a considerable exporter if those plants, as well as the one at Trail, British Columbia, all operate at capacity. It is estimated that Canada uses 50,000 tons of copper a year. The total production of which the plants would be capable would be in the neighbourhood of 200,000 tons. At present there is a bounty of ¼ a cent. a pound paid by the Dominion Government on copper refined in Canada from Canadian ore and used in Canadian manufacture. There is also a tariff against certain types of bar metals.

Tonnage of Gold-bearing Ore.

Ore taken from the gold mines of Canada in 1929 totalled 4,354,744 tons, of which 4,252,994 tons were milled. Tailings retreated amounted to 48,707 tons; gold bullion recovered by amalgamation at nine mines amounted to 162,222 crude ounces and by cyanidation 1,893,760 crude ounces. Shipments of bullion having a total value of 34,752,341 dollars amounted to 2,087,680 crude ounces, containing 1,669,932 fine ounces of gold and 261,540 fine ounces of silver. Ores, concentrates and high-grade slags shipped to smelters totalled 120,794 tons, having a net value—less freight and treatment charges—of 2,523,645 dollars. These shipments contained 101,594 fine ounces of gold, 2,426,333 fine ounces of silver, 9811 lb. of copper, and 1,467,175 lb. of arsenic.

Phosphatic Fertilisers.

Gratifying results of experiments in the use of phosphatic fertilisers for grain crops conducted in the provinces of Manitoba and Saskatchewan have been announced. The experiments were conducted by the Departments of Agriculture, in conjunction with the Dominion Experimental Farms, the Canadian Pacific Railway, and the Consolidated Mining and Smelting Company, of Canada. An extensive trial of both ammonium phosphate and triple superphosphate was carried on over a period of three years on hundreds of farms in the Prairie Provinces. In Manitoba these fertilisers drilled in at the time of seeding gave increased yields of wheat ranging from 18 to 50 per cent. over the untreated crops and corresponding increases with other grains. In Saskatchewan it was found that the use of the fertiliser produced more even crops, as it tended to neutralise soil variation.

Paper Production Increase.

A large increase in newsprint manufacturing capacity has just become effective in British Columbia's pioneer industry of this kind in the addition of a seventh paper machine at the mills of the Powell River Company at Powell River, 75 miles up the Pacific Coast from Vancouver. The seventh machine has a rated capacity of 150 tons of newsprint daily and raises the total mill capacity to 630 tons of this commodity per day. Its installation is part of an expansion programme which has been under way for more than a year and which includes a large hydro-electric development on the Lois River about 14 miles from the mills. First power from the new plant is expected to be available about March of this year from an initial unit of 24,800 H.P. Construction will then be commenced on a second unit of similar size. The power will be transmitted to Powell River over a 66,000-volt transmission line now ready.

Shipbuilding Record.

The Canadian Pacific has spent 100,000,000 dollars for new steamships in the past ten years, according to Mr. William Baird, steamship passenger traffic manager of that company. New vessels launched during that time numbered fifteen, and, in addition, the company built several fine ships for its coastal trade. Canada's growing importance as a maritime nation, Mr. Baird points out, is indicated by the fact that a Canadian company has just completed the greatest shipbuilding programme ever instituted by a private company, with the construction of 198,500 tons of ocean-going shipping in three years.

Noranda Operations.

Noranda was the chief producer of metal in the province of Quebec during 1930. Early in the year the production attained a rate of around 8,000,000 lb. of copper monthly, but that declined somewhat later in the year. Officials planned an output of about 100,000,000 lb. of copper and upwards of 2,000,000 dollars in gold for the year. The gold output was maintained and gradually increased and had attained around 250,000 dollars per month during the closing months of the year. Efforts are now turned toward drawing upon the sections where gold values are above average and where copper content is lower. The outlook for 1931 indicates possibly 3,500,000 dollars in gold as a by-product.

Obituary Notes.

The death of Major Charles F. Hannington is announced as having taken place at Ottawa on December 21st, at the age of eighty-two years. Major Hannington was the last of a group of notable engineers, who were associated with Sir Sanford Fleming in surveying the proposed routes for the transcontinental line of the Canadian Pacific Railway. He was born at Shediac, N.B., his father being the Hon. Daniel Hannington, member of the Provincial Legislative Council. Much of his professional career involved explorations and surveys of the Far West, where many engineering difficulties were encountered, in the Rocky Mountain region, which were successfully overcome. On the breaking out of the Great War Major Hannington, although nearly seventy years of age, joined the Canadian forces and saw service overseas. Another prominent engineer, Colonel Reuben Wells Leonard, of St. Catharines, Ont., died on December 17th, at the age of seventy years. He was born at Brantford, Ont., and after graduating at the Royal Military College, Kingston, joined the staff of the Canadian Pacific Railway, where he speedily obtained promotion. He saw active service during the Riel Rebellion, and on resuming his professional work he was appointed engineer of survey and construction in Manitoba and Ontario, afterwards occupying other responsible positions in connection with railway extension, and being in charge of the first hydro-electric development, at Niagara Falls, Ont., for the Park and River Railway. Colonel Leonard was selected by the Dominion Government in 1911 as Chairman of the National Transcontinental Railway Commission, with jurisdiction over the construction of the Government Railway from Moncton, N.B., to Winnipeg. When silver was discovered in the Cobalt area he devoted his attention to mining engineering, being one of the first to enter the field, where he secured a controlling interest in the Coniagas Mine. He was also interested in the steel business and was a director of several industrial corporations.

JAPANESE STEEL FOR SIAMESE RAILWAYS.

(By our Special Correspondent.)

TOKIO, January 21st.

EACH year the Government Railways of Siam call for tenders for the supply of steel, which are open to all steel makers, and during the past three years, the Japanese Bridge Builders' Association, through its agents, the Mitsui Bussan Kaisha, Bangkok Branch, has submitted estimates. In two successive years the French were successful. News has just been received that this year the Japanese tender is the lowest, and the fact of this success in open competition with the world's steel makers has caused no little elation in Japan, the Minister of State for Railways, Dr. Egi, adding his congratulations and speaking hopefully of Japan's future prospects in the world market. The Japanese bid was successful against some forty competitors of Belgian, Czecho-Slovakian, French, German, American and British nationality. The contract is for the supply of 500 tons of steel for new construction and replacement—plate girders, lattice girders, culverts, &c. Mitsui's bid was not less than yen 100 per ton delivered in Bangkok. A German bid was second lowest. American bids were highest.

The Government Steel Works in Kyushu will supply the steel, which will pass Japanese Government Railway Specifications, which are severe. While there will be but small profit in this, the first, Japanese contract for the supply of steel to a foreign Government it will be of advertising value. Railway engineering in Japan has come much to the fore in the past year. Her engineers are busy in the railway shops of Moscow and other Russian centres, and a Japanese has been engaged by the Persian Government as railway adviser. The Siamese deal will be so handled as to enhance the reputation of the island Empire of the East, which is making a name for itself in a department of activity hitherto confined to a few Western nations, whose one-time monopoly in so many branches of engineering is now at an end.

SIXTY YEARS AGO.

THE railwayman of to-day, with his powerful trades unions and his standard forty-eight-hour week, is, however he may grumble at his pay, highly favoured by contrast with the conditions under which his fellow-railwaymen had to work sixty years ago. Two paragraphs in our issue of February 17th, 1871, are symptomatic. In one we recorded that the numerous accidents that had occurred recently had alarmed not only the public but the railwaymen themselves. The signalmen and pointsmen of Yorkshire had held a meeting, and had resolved that they were being asked to work hours that were too long for pay that was too little. They decided therefore that the directors of the various companies should be petitioned to shorten the one and increase the other. They were not, however, the only classes of railwaymen who had a grievance, if the information contained in another paragraph presented a true account of what had happened at a meeting of the Midland Railway Company's shareholders. Mr. Bass, M.P., had tried to induce the shareholders to take into consideration the long hours during which their servants were employed. He was subjected to considerable interruption when he gave particulars of men who as recently as the previous month had been kept on their engines for from twenty-three to thirty hours at a stretch. He contended that the labour rendered in those circumstances could not be of the best, that the company's engines were being worked under conditions imposing undue wear and tear, and that the safety of the travelling public was being imperilled. He moved that the directors should appoint a committee of the whole board to consider the hours of labour of the company's servants. His motion was duly seconded, but on being put to the meeting was defeated. . . . Two items of railway history are to be culled from the same issue. We read that the Lancashire and Yorkshire Company had decided to set aside from its earnings a sum of £5000 for the widow of its late chairman, Mr. Wilson. Mr. Wilson had been a director of the company since 1846, and had subsequently become its vice-chairman, and finally its chairman. Among his services to the undertaking was numbered the fact that he had been "mainly instrumental in working out the invention for consuming coal in place of coke," in the company's locomotives, an invention which had led it to save £50,000 a year. In our correspondence columns "W. R. N.," of Merthyr Tydfil, asked for consideration for Adrian Stephen, "the inventor of the steam whistle." Stephen, he said, was still alive. He had not, however, taken out a patent for his invention, and was still forced to earn his livelihood by hard work. Indeed, our correspondent had recently seen him passing along the street with a basket of tools on his back. Yet without his invention the lives of all who travelled by rail would be placed in far greater jeopardy than they were at present.

ARC WELDING.

PRIZES to the total value of 17,500 dollars are being offered by the Lincoln Electric Company, Cleveland, Ohio, for papers on "Arc Welding."

The purpose of the competition is to increase the knowledge of the adaptability of arc welding to industry, more especially of the adaptability of welding in the redesign of present machinery from cast iron or riveted steel structures to welded steel structures. The advantages of arc welding processes are not understood in many quarters. When they are understood, it is believed that enormous reductions in cost will be made by their use, and that vast improvement in the finished product will be obtained.

It is also the purpose of this competition so to focus the attention of the management and engineering departments of manufacturing companies on this subject that they will attempt to redesign their equipment to the use of arc welding as a manufacturing tool, thereby bringing to their knowledge the advantages, economies and possibilities that the newer processes of welding hold.

It is a further purpose of this contest so to frame the rules for judgment of papers that consideration is given to the proportionate saving to be made by the application of arc welding to a design. This is done to open the competition to those who are engaged in the fabrication or manufacture of products which in gross economic volume occupy positions considerably below the largest. It is the definite purpose to open the competition to those engaged in the smaller industries as well as to those in the larger ones.

Any person, or group of two or more persons, in any country of the world may submit a paper in this competition. Only one paper from any competitor or group will be eligible. Employees of the Lincoln Electric Company are barred from the competition.

The subject matter of the paper must come under one of the following headings:—

(*a*) A description of a useful machine, structure, or building, previously made in some other way, that has been redesigned in whole or in part so that arc welding is applied to its manufacture.

(*b*) A description of a machine, structure, or building not previously made that has been designed in whole or in part to the use of arc welding and a description showing how a useful result is obtained which was impractical by means of other methods of manufacture. It is not necessary that the machine as redesigned should have been manufactured at time of writing of the paper.

Any paper arriving in Cleveland after October 31st, 1931, will be disqualified. Further particulars can be obtained from the company.

A LIGHT SUBSTITUTE FOR CHEQUER PLATING

AMONG the newer forms of construction for such purpose as engine-room gratings, walkways, and factory staircases, which we have seen, one of the most satisfactory appears to be that recently introduced by Grill Floors, Ltd., of 200, High Holborn, London, W.C. 1. It is of the type built up of flat bars in the place of the old-fashioned round rods, and has several notable features.

The bars, which, of course, stand on edge, are generally 1in. by ¼in., but for extra wide spans may be 1½in. deep. They are bright, so that they will readily take paint. These bars are pierced at intervals with slots, about ⅝in. wide, half-way above the neutral axis. Through these slots there are threaded other, transverse, bars, ⅜in. by $^{3}/_{16}$in., while the main bars are spaced apart by 1⅛in. When the assembly has been made, the transverse bars are twisted through 90 deg. in each of the spaces between the main bars. The result of this process is that the transverse bars have a sharp twist as they emerge from the slots in the main bars, on either side, and the whole structure is locked tightly together. In the process of twisting one edge of the transverse bars is brought slightly above the general level of the grating to provide a foothold.

The reason for setting the transverse bars above the neutral axis is obvious, as it is that part of the bar which is under compression when the grid is under load, and thus tends to buckle. Consequently, there is a neutral support from one bar to the other, while the lower part of the main bars being in tension does not require transverse support. Incidentally, the adoption of a slot weakens the bar less than a round hole of corresponding area.

The sections of floor are made up in sizes ranging from a stair tread to pieces about 2ft. by 7ft., but it is obvious that there is no close limit to dimensions. They are each surrounded by a frame to which the main bars are attached by acetylene welding. The attachment to the structure can be made in a variety of ways, by clip bolts, by drilling the transverse members, or by merely dropping the grills on angle iron frames.

The material seems to us to have the advantages that it is light by comparison with other forms of grating, it is rigid, and can be painted properly, as there are no sharp corners. Incidentally it will pass a great deal of light, which is an important point in many engine-rooms.

ELECTRICALLY-OPERATED GEAR-DRIVEN WINDING PLANT

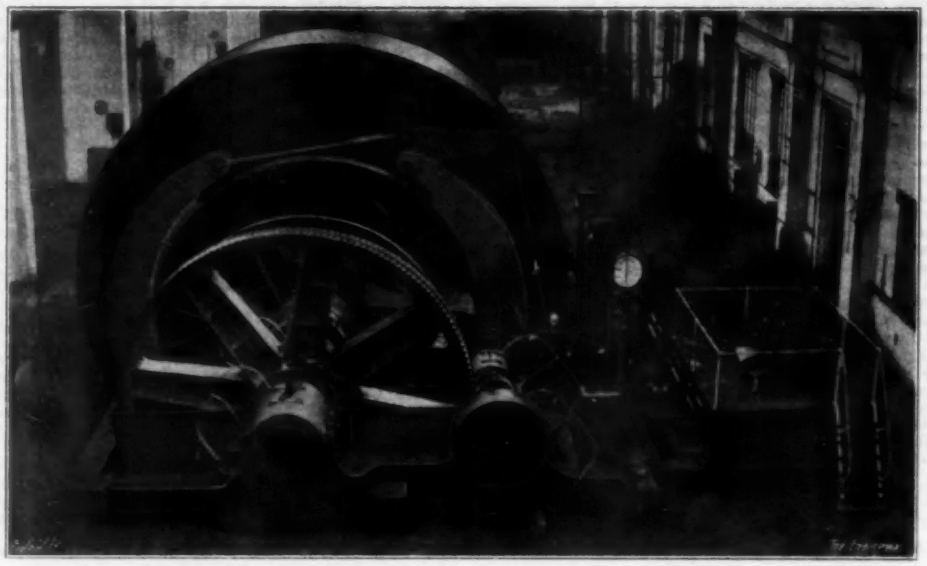


FIG. 1—END VIEW SHOWING REDUCTION GEAR

Electrically-Driven Winding Plants.

THERE have recently been constructed at the Openshaw Works by the English Steel Corporation and Vickers-Armstrongs, Ltd., two interesting electrically driven winding plants for South African Gold Mines. One of these, shown in Figs. 1 and 2, is of the geared type and has a bi-cylindro conical drum, 15ft. diameter on the outer barrels, the hoisting ropes being led by means of spiral cones to the centre barrel of the drum, which is 30ft. diameter. The drum is driven by means of an A.C. motor through a flexible coupling and single reduction machine-cut triple helical gears having a ratio of 8·43 to 1, the wheel being of cast steel and the pinion of forged steel. The second winder, the control platform of which is illustrated in Fig. 3, is of the direct-coupled type driven by a D.C. motor coupled to each end of the drum shaft by flanges forged solid on the shafts. In this case there are two cylindro-conical drums, each 12ft. diameter on the outer barrel, the hoisting ropes being led by spiral cones to barrels 24ft. diameter. One drum is keyed to the shaft while the other is loose and is driven by a multiple tooth clutch, the sliding member of which fits on splines machined on the shaft and is operated by a compressed air engine.

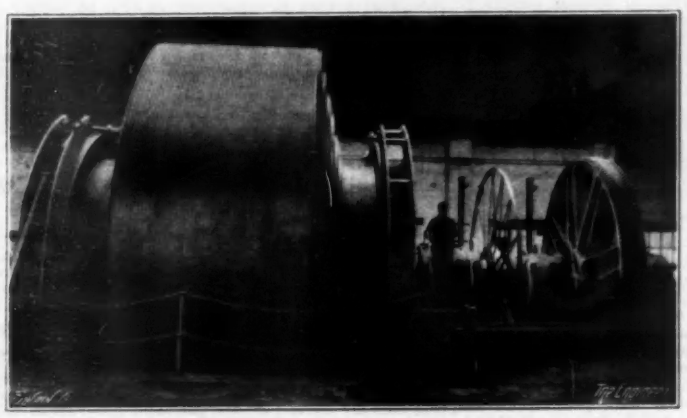


FIG. 2—SIDE VIEW OF GEAR-DRIVEN WINDER

Three methods of interlocking the clutch and the brake on the loose drum are provided to ensure that the brake cannot be released when the clutch is out of engagement. One of the interlocks provides that the teeth of both clutch members must be in actual engagement before the brake can be released. This is an additional safeguard to those usually provided, which are rendered inoperative in the event of neglect to adjust the brake blocks to compensate for wear, or in case the clutch teeth are not in a position to engage when the clutch engine lever is moved to the "in" position. The latter contingency is said to have been the cause of serious accidents which the additional interlock would have prevented.

The following constructional features are common to both winders. The drums are of cast steel throughout; the barrel parts have machined helical grooving for the ropes and the whole of the outside surface of the cones is machined. The 15–30ft. drum has two spools for storing spare rope arranged on the outside of the drum and rotated by means of a compressed air engine. This winder has two sets of brakes, whereas the 12–24ft. drums have one set of brakes each. The brakes are of the suspended post type applied by dead weights, and each set is operated by a compressed air engine fitted with Iversen control gear. In cases of emergency the brakes are applied by a special lever on the platform and automatically applied in the event of a solenoid becoming de-energised through any of the following causes:—(1) Failure of current in the main circuit; (2) tripping of the switch on the depth indicator in the event of overwinding; and (3) tripping of the emergency switch on the driver's platform. The brakes will also be applied should the air pressure fail.

The emergency application of the brakes is effected by special exhaust valves on the brake engines independently of the Iversen control gear. This arrangement is positive in action, no objectional lost motion being required in the connecting gear as in the case with the usual trip catch for operating the brake engine control gear. The emergency valves are operated by a falling weight normally sustained by air pressure in a cylinder, the function of the solenoid being merely to operate a valve on the sustaining cylinder. This valve exhausts the cylinder to apply the brakes and re-admits air under pressure to reset the brakes when the solenoid is re-energised. By this means an ample weight can be used to ensure certainty of operation of the emergency valves. Fast braking is applied at the retardation point of each wind by means of a cam driven from the drum. In the case of the A.C. winder overspeeding and overwinding are prevented by a Lilly controller.

The D.C. winder is provided with cams for controlling the rates of acceleration and retardation, the latter being arranged to commence moving the control lever towards the neutral position at the retardation point, thus gradually bringing the winder to rest at the end of the wind, an operation which is carried out independently of the driver should he fail to use the control lever at the correct moment. It should be stated that all the bearings for the drum shafts are of the self-aligning ring-oiled type and the control shafts are supported in ball bearings throughout. The leading particulars of the two winders are as follows:—

A.C. Winder with 15–30ft. Drum.

Capacity	180 tons per hour
Net load hoisted each wind	6 tons
Total weight hoisted each wind	29½ tons
Depth of wind	3842ft.
Speed	2750ft. per minute
R.M.S. H.P. of motor	2221
Peak H.P. of motor	3672
Peak H.P.—hoisting men	3731

D.C. Winder with Two 12–24ft. Drums.

Capacity	288 tons per hour
Net load hoisted each wind	8 tons
Total weight hoisted each wind	25½ tons
Depth of wind	3595ft.
Speed of wind	3000ft. per minute
R.M.S. H.P. of two motors	2661
Peak H.P. of two motors	4569
Peak H.P.—hoisting men	5647

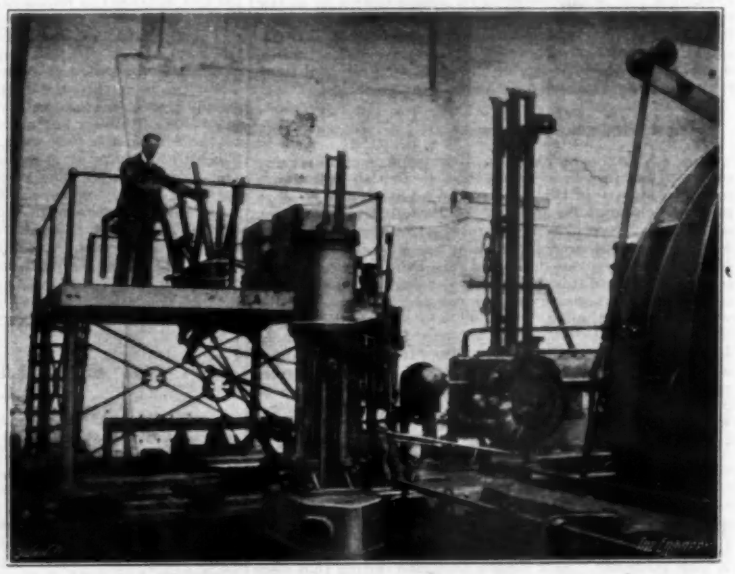


FIG. 3—CONTROL PLATFORM OF DIRECT-COUPLED WINDER

Petrographic Treatment of Coal.

THE following is an abstract of a paper, entitled "The Petrographic Treatment of Coal: The Mechanical Separation of Coal into its Constituents and their Commercial Applications," by Mr. John Strevens, which was read before a meeting of the Institute of Fuel on Wednesday, February 11th:—

The mechanical separation of coal into vitrain, clarain, durain, and fusain is possible by means of elastic percussion, and the methods worked out for it are both simple and economically sound. The best method, in the opinion of the author, is the use of pendulum mills in association with preliminary dry cleaning when the ash content of coal is high.

Tests carried out accompanied by petrographic analysis, have shown that the elastic percussive treatment accompanied by fairly powerful suction throughout the appliance, results in almost complete separation of the fusain, without screening. It has also been shown that a vitrain content up to 85 per cent. and a durain content up to 80 per cent. may be obtained in the respective fractions.

Generally speaking, the vitrain fraction is best adapted for coke manufacture, and the clarain-durain fraction for retorting, gas manufacture, hydrogenation, and for blending with highly swelling coals. The fusain can be directly applied for powdered fuel firing or as a raw material for colloidal fuel.

That the subject is being taken seriously in Germany is proved by the fact that a number of the leading coal-dressing plant concerns in combination with the Ruhr associated mining interests, have definitely adopted petrographic separation on the Lehmann principle, and with the experience gained from the testing of hundreds of tons of various German coals in the pilot plant at Brassert will construct plants at various strategic centres for the treatment of these coals.

For British coals, the pilot stage has yet to be passed through, and doubtless with clarain-rich coals certain modifications of the treatment will be necessary. Petrographic separation, especially for those of our Dominions, where the coals are associated with cannels and torbanites, brings nearer the stage of economic production of oil from solid carbonaceous material. For countries poor in coking coals, it opens a way to produce cokeable material from such deposits by removal of durain. Durain itself being a valuable raw material for gas producers and oil extraction, as well as having certain other uses in "blending" for coking purposes, is not likely to lack ever-increasing markets, whilst fusain will always be considered as a by-product.

To those collieries which are deficient in high-grade bituminous and coking coals, but are rich in the younger and higher volatile weak to non-coking coals, petrographic treatment should particularly appeal. Here it should be possible to purchase cheap run-of-mine coal, which is the least subject to fluctuating market conditions, and therefore capable of being purchased on long-dated contracts, and work it up into products of value. Thus both Canada and South Africa could ultimately expect to produce from their own coals all the gas coal they need, and vitrains sufficiently rich in coke forming constituents to yield a good furnace coke. By its adoption on a wide scale, it is not a fantastic picture to visualise the centres of gravity of the coal industry shifting as deposits suitable for such treatment are opened up, besides the throwing of a lesser strain on the known good coking coal deposits and giving them a longer life, irrespective of the rate of growth of the steel industry.

THE Canadian Pacific has spent 100,000,000 dollars for new steamships in the past ten years, according to Mr. Baird, steamship passenger traffic manager of that company. New vessels launched during that time numbered fifteen, and, in addition, the company built several fine ships for its coastal trade. Canada's growing importance as a maritime nation, Mr. Baird points out, is indicated by the fact that a Canadian company has just completed the greatest shipbuilding programme ever instituted by a private company, with the construction of 198,500 tons of ocean-going shipping in three years.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

General Situation.

IN the Midlands and Staffordshire the demand for iron and steel continues poor, and market activity is limited to the purchase of small tonnages of material required for immediate making up. Most of the heavy trades in the district are but moderately employed, trading conditions in almost every case being reported as dull. There has been no staple reinforcement of business so far this year, though there have been flickers of improvement here and there. They have failed, however, to develop into a blaze. Manufacturers are looking to the forthcoming British Industries Fair in the hope that some really large business will be secured there, and there are traders who optimistically think some reinvigoration of demand may set in following the gathering together of so many producers and consumers. Exhibitors are determined to set a cheerful tone, realising that confidence is more likely to be established thereby than by giving way to the depressed view which in many instances present trading conditions amply justify. Values of both iron and steel materials and of manufactured goods are very unstable just now. Competition is very keen and prices vary in individual transactions. Sellers are anxious to dispose of their products, and are, in numerous cases, prepared to make sacrifices in order to liquidate stocks or to keep plant running. This juggling with selling prices does not tend to increase confidence, neither does it stimulate demand, and, apart from securing an occasional order against competitors, those who indulge in it gain very little. General readjustments of selling prices are not anticipated until demand improves, consequently less interest is displayed in the Midland market than is customarily the case, and attendances at the weekly meetings have of late been much below normal.

Steel.

Steel business continues to drag. Midland constructional engineers have recently placed a few orders for material, but there is no real expansion of the tonnage needed for current work. Orders are in many cases accompanied by requests for delivery within a few days. Though steel works are usually able to do that, there is sometimes delay. The steel maker with perhaps only half his plant working, finds it difficult to comply with a request for very early delivery of an order. Trade conditions do not warrant any increase in operating plant, and delays occur because the works are dealing with small specifications for a variety of shapes and sizes. Special steels for the automobile industry are in regular request, but orders are small. Plate mills are unable to make full time, there having been a decided falling off in demand recently. Finished steel prices are maintained at the Association's fixed level. Angles are £8 7s. 6d., tees £9 7s. 6d., joists £8 15s., ship, bridge and tank plates £8 17s. 6d., less their respective rebates to those who buy only British material. Boiler plates are quoted £9 5s. Values of semi-finished steel continue to depreciate, though quotations are generally upheld at recent levels. When it comes to business, however, sellers are often prepared to accept prices much below those quoted on the market. Some of the figures at which bars and billets are said to have changed hands are undoubtedly exceptional, and apply only as between steelmasters and very good customers whose business they are eager to maintain. Staffordshire re-rollers ask £7 7s. 6d. for bars in which the raw material is foreign, but that figure does not indicate the bottom of the market. Similarly, £5 10s. for billets would probably not be insisted upon if a small concession would influence business. There is very little business of any kind about, and mills have difficulty in keeping plant in operation. Importing merchants offer supplies at low rates, but they do not appear to be any more successful in getting business than are the district steel masters. The consuming industries are decidedly quiet, and until matters mend there is little likelihood of a lasting improvement in the steel-producing works of this district.

Raw Iron.

There is very little movement in pig iron within the Midland area, a reflex of the state of trade in the consuming industries. Foundrymen and forgemen buy sparingly. Merchants negotiate with the foundries for small orders sufficient as a rule to keep the works from running out of stocks. Hardly anywhere is it possible to arrange contracts. Users are so uncertain in regard to their future activities that they consider it wise to buy material just when it is necessary for current consumption. Forges are not so well situated as foundries, and the demand for forge qualities is very dull. Small quantities of hematite come into the district from the North-East Coast and South Wales. Unfortunately, there are no indications of an expansion of general consumptive demand, or of the probability of such in the near future. Prices of Midland pig irons remain at £3 7s. 6d. for Northamptonshire and £3 11s. for Derbyshire and North Staffordshire for delivery at Black Country stations. Forge material is 5s. per ton less in each case. Stocks of iron at the furnaces are large, and especially in Northamptonshire. Blast-furnacemen in that area are reported to be keenly competing for business in the North, and even in Scotland, and to be meeting with some success. The prices at which this business is accepted is said to be substantially below those which Midland foundrymen are called upon to pay. Smelters do not claim to be making any profits from this business, but it is a means of reducing their exceptionally heavy stocks, and for that reason alone it is very acceptable.

Wrought Iron.

The Staffordshire finished iron trade shows no improvement in general conditions, and financial stringency prevents many would-be users of finished iron from placing orders. The steady demand experienced for higher grade engineering bars is the one bright spot in the industry. Even here, however, mills are to some extent sharing in the general trade depression. There has been no movement of importance in this branch of trade during the week, and what few transactions have been negotiated have for the most part been at the minimum selling rates. These are:—Marked bars, £12 10s.; Crown quality, £9 15s.; nut and bolt and fencing bars, £8 15s.; wrought iron gas tube strip, £10 17s. 6d. Except in the best bar branch, values are said to be unremunerative. Competition from outside districts in the Crown bar branch is maintained, while in the common bar department it is intensified. Belgian No. 3 iron bars can now be bought at £5 2s. 6d. delivered. Sales, whether of native or foreign material, are few and small.

Galvanised Sheets.

Demand for galvanised sheets is very backward, and mills are still badly off for export orders. Intensified international competition in a sluggish market has had an appreciable effect upon turnover in the sheet trade. None of the overseas markets is taking its normal supplies, the business tone being no better now than it was a month or so ago. Belgium mills continue to cut the price and shippers say that the boycott of British goods remains an influential factor in the Indian trade. The Australian market has not recovered any strength, and orders from South America and the West Indies are infrequent, and not of great bulk. Orders on home account are fairly satisfactory. Prices are steady on the basis of £11 per ton for 24 gauge corrugateds.

Institute of Foundrymen.

The annual dinner of the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen was held on Saturday at the Grand Hotel, Birmingham. Mr. D. Wilkinson—President of the Branch—presided. Dr. Stirling Anderson—Principal of Central Technical College, Birmingham—who proposed the toast of "The Institute of British Foundrymen," said that the first meetings of the parent Institute, founded in 1904, were held in the Central Technical College. To-day the Institute and the College were both, in a disinterested way, striving to do their best to help the foundry industry. The Institute now had just over 1800 members. Its aims were purely educational. The art of the foundrymen was of ancient date; indeed, there were those who claimed that the craft was as old as civilisation itself. The part played by the founder had always been a very honourable one, and that was probably due to the fact that he was engaged on one of the primary processes of production. Mr. C. E. Lloyd, in upholding the toast, remarked that Birmingham had great interest in the industry, but he was surprised to find that just a hundred years ago there were 123 blast-furnaces in South Staffordshire. That showed progress in the industry had not been maintained. Mr. F. P. Wilson—President of the National Council of British Foundrymen—in responding, said that the Birmingham Branch awas the oldest in the Institute, having been founded in 1904. The Branch was showing signs of definite increase in membership, and was in a favourable position because of the help given to it by the Birmingham University and the Birmingham Central Technical College. The Lord Mayor, responding to "The City of Birmingham," proposed by Mr. P. J. Hannon, said that the presence of coal, iron ore and foundry moulding sands in the district had helped Birmingham to establish the tradition it had held for so many years. He was a thorough believer in co-operation between the city and industry. In these days neither the city nor industry could afford to have misunderstandings and lack of co-operation between the various units in industry. The toast of "The Branch" was proposed by Mr. J. Linabury, of Detroit, who said that many of America's best foundrymen came from England, while the products of Birmingham foundrymen went to all parts of the world. The response was made by the Branch President, Mr. D. Wilkinson.

Agreement in North Staffordshire Coalfield.

Agreement was reached on Saturday last on the spread-over in the North Staffordshire coalfield. From Monday last the hours of work underground are 7 hours 48 minutes on Monday, Tuesday, Wednesday, Thursday, and Friday, and 6 hours on Saturday. The wages and conditions in operation in November last will continue. The agreement is in accordance with the recent recommendations of the National Coal Board.

Midlands to U.S.A.

The return of goods exported from the Midlands to the United States of America last year indicates a substantial decline in volume. The fall in value was greater in proportion than the drop in quantity, owing to the downward course of prices throughout the twelve months. It is interesting to note the record of various classes of Midland products shipped to America during 1930. Brass manufactures exported were worth 121,417 dollars; fishing tackle, 125,901 dollars; needles, 273,923 dollars; pens, 135,570 dollars; pins, 40,620 dollars; steel sashes, 151,289 dollars; steel tubing, 226,057; tin-plates, 28,847 dollars; metal manufactures, 166,890 dollars; machinery and vehicles, 223,414 dollars.

Decrease in Unemployment.

A slight decrease in the number of persons unemployed in the Midlands is shown by the latest returns. There are now 227,452 wholly unemployed, 127,627 temporarily stopped, and 592 normally in casual employment, making a total of 355,671. This is 234 less than a week before, and 161,253 more than a year ago. The total comprise 237,324 men, 7989 boys, 101,529 women, and 8829 girls. The total of unemployed in Birmingham is 60,374; Stoke-on-Trent, 34,907; Coventry, 10,461; Derby, 11,417; Leicester, 15,579; Nottingham, 15,590; Walsall, 10,384; and Wolverhampton, 12,864. In the Black Country areas increases on the week are recorded at Bilston, Tipton, Stourbridge, and Brierley Hill, Wednesbury, and Wolverhampton, and decreases at Cradley Heath, Dudley, Oldbury, Smethwick, Walsall, and West Bromwich.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Further Dock Developments.

A WEEK or two ago announcement was made in this column that the Manchester Ship Canal Company had under consideration plans for constructing a new oil dock at Ellesmere Port with a view to largely increasing the storage capacity of the existing Stanlow oil dock. Further important dock developments which, it is expected the Ship Canal Company will undertake in the near future have been discussed here during the past few days. They arise out of the recent formation of the Lancashire Steel Corporation and the Wigan Coal Corporation. The scheme provides for the construction of a new dock on the banks of the Ship Canal at Irlam to facilitate the transport of raw materials to the Partington Steel and Iron Works, which form an important part of the organisation of the Steel Corporation. It is understood that the actual work of construction will be put in hand before very long. Provision will, of course, be made for the installation of modern cargo-handling plant.

Dutch Cables for Salford.

With almost machine-like regularity the members of the Salford City Council discuss the advisability of placing orders for electrical cable with Dutch firms, and, with equal regularity, during the past few years, a substantial proportion of the city's cable needs has been satisfied from Holland. The question again arose at the last meeting of the City Council on a recommendation of the Electricity Committee, but an amendment to award the order to British makers was defeated by 26 votes to 21. In opposition to the amendment it was asserted that the British cable combines were driving trade out of the country because of the exorbitant profits they were making, and that whilst they could compete in foreign markets and actually secure orders in face of world-wide competition, in the home market their prices were too high.

Leeds Contract for Manchester Firm.

Edward Wood and Co., Ltd., constructional engineers, of the Ocean Ironworks, Trafford Park, Manchester, have secured an order, valued at about £30,000, for the steel framework for Leeds Corporation's new civic buildings. About 2000 tons of steel will be needed.

Industrial Results.

Mather and Platt, Ltd., of Newton Heath, Manchester, have declared a final dividend on the ordinary share capital of 5 per cent., making a total of 10 per cent. tax-free, for the past year. This compares with a total distribution of 15 per cent., for in each of the eight previous years the ordinary shareholders received a bonus of 5 per cent. A marked reduction in the company's profits is indicated by the fact that the sum to be carried forward amounts only to £55,752, against £109,855 at the end of 1929. Satisfactory financial results have attended the operations of Leyland Motors, Ltd., Leyland, near Preston, for the twelve months to the end of last September. The gross profits amount to £699,000, compared with £761,030 in the previous year, and, after paying the remaining three years' dividend arrears on the 7½ per cent. cumulative preference shares, the directors have decided to pay a dividend of 20 per cent. on the ordinary shares, which is the first payment these have received for some years.

Personal.

Mr. F. W. Goodman has been appointed Borough Engineer of Clitheroe at a salary of £500 a year. Mr. Goodman formerly held appointments at Leicester, Gloucester and Chelmsford.

Non-ferrous Metals.

Following upon an unsatisfactory spell, all sections of the non-ferrous metals market during the past week have been appreciably firmer, and price advances have been general. In spite of the fact that there has been no marked improvement in the statistical position of the metal, better advices from foreign producing centres, coupled, no doubt, with renewed belief in the final success of the output restriction proposals, have exerted a steadying influence on tin prices, the whole of the loss during the previous week having been wiped out, leaving a net gain on balance of rather more than £5 a ton. Notwithstanding that the outlook for the metal must still be regarded as uncertain, a more hopeful view is at present being taken, though some degree of reaction after the past week's rise seems inevitable. Copper is dearer to the extent of nearly £2 a ton, compared with a week ago, the whole of the recovery, which has brought prices back to where they were early in January, having occurred in the opening days of the present week. So far as the British markets are concerned, however, there has been no appreciable improvement in the demand for either standard or refined descriptions. There has been a moderate buying movement in the case of both lead and spelter, and values are higher on the week by about 15s. and 10s. a ton, respectively.

Iron and Steel.

Having regard to the generally depressed state of Lancashire foundries, sellers of pig iron on this market are not complaining unduly of current trade, for if no expansion can be reported, there has been little falling off in total deliveries into consumption locally, compared with a month or two ago. There has, however, been no disposition to enter into fresh forward commitments, users still being content for the most part to buy on what is virtually a week-to-week basis. West Coast hematite iron is cheaper, but, in all other respects, prices are maintained, Staffordshire and Derbyshire No. 3 being quoted at 69s. 6d. per ton, Northamptonshire at 68s., Scottish at up to 91s., and West Coast hematite at 82s. 6d., all for delivery

equal to Manchester. The demand for finished iron is disappointingly slow, but values keep up at £10 5s. per ton for Lancashire Crown quality bars, and about £8 15s. for No. 2 material. Recent orders that have come the way of constructional engineering firms in this part of the country have served to counterbalance work that has been completed, without, however, effecting much net improvement in the general position. Locomotive engineering firms locally are, for the most part, in need of work, and the demand for boiler plates and other varieties of steel from this direction is no better than it has been for several months. Almost on all hands one hears complaints from rollers of the marked scarcity of forward buying, users pretty well confining operations to current requirements.

BARROW-IN-FURNESS.

Hematite.

The hematite pig iron market continues to be on the quiet side, and home buyers are only ordering sufficient to meet immediate requirements. The fact that the steel departments are engaged means that the home demand for iron is fair, but, despite this, stocks continue to be heavy. Business with the Continent is not brisk, and of late there have not been many shipments. American business is quiet. In view of keen competition local iron producers have had to ease their prices with a view to keeping in the market. At Backbarrow, refined iron is being produced. These works were, at one time, the only makers of charcoal iron in the country, but just over two years ago they went over to more modern methods of production. A little charcoal iron is still available. The iron ore trade is on a moderate scale, and local mines are not producing at anything like their full tonnage. Foreign ore is in fair demand. The steel trade is not brisk by any means, but the Barrow and Workington mills are engaged on railway material. It is difficult to say at present how long they will be able to run, but further contracts would be welcome.

SHEFFIELD.

(From our own Correspondent.)

Steel Conditions Unchanged.

THERE is nothing to show that conditions in the steel trade as a whole are any better, or that the tide of depression has yet taken the long-desired turn. In nearly every branch of the industry, reduced turnovers are reported, and the exceptions to this rule are few. The production of open-hearth steel is on a rather larger scale than before the Christmas stoppage, but the increase is not sufficient to warrant any hope of a real revival. While small orders continue to come to hand, business for bulk quantities is very scarce, and inquiries are not promising. The rolling mills are experiencing a better call for sheets, mainly on export account, but trade in rods and bars is still very depressed. The call for special lines of steel is fair, but not up to the average, owing to the fall in the overseas demand. The output of ordinary crucible steel has fallen to a level which is probably as low as it has ever been. This is due, to some extent, to the competition of other grades of steel and other systems of melting. There is much quietude in the market for steel scrap. The heavy steel works have not yet begun to make forward purchases, and dealers are finding it difficult to dispose of quantities at a reasonable price. There has been a fall of 3d. per pound in the price of tungsten, which is an important ingredient in the manufacture of high-speed and other alloy steels. Consumption of this material has fallen to a very low level, and forward business is extremely difficult to obtain.

The Manufacturing Side.

The call for automobile supplies generally—forgings, pressings, stampings and alloy steel and tools—keeps up fairly well so far as commercial cars are concerned, but is on a low scale as regards touring vehicles. The departments manufacturing railway axles, tires and springs are still very poorly employed, and are anxiously awaiting the placing of the first orders in connection with the Chinese Boxer indemnity allocation. The position in the acid-resisting and heat-resisting steel section is healthy, and full of promise. It is reported that large orders have been placed with Sheffield firms for spades and forks required in connection with the scheme of the Government for assisting unemployed men in cultivating allotments. The demand generally for garden tools has improved lately, but it is not expected that this season will be equal to last year's. Dealers report a tendency to buy the cheaper classes of goods. There is but a moderate outlook for the trade in agricultural implements and tools, as farmers, in consequence of their poor trade last year, are not in a position to make large purchases. In hand and engineers' small tools, the export markets are much depressed, and a majority of Sheffield firms are, consequently, experiencing reduced turnovers and finding it necessary to work short time. There is more activity in the home trade and a few houses are moderately well employed on this account.

Colliery Developments.

Even in these days of difficulties in the coal trade, plans for the development of new collieries are being thought out, and one of these, in the Barnsley district, is to be put into operation without delay. This is at the Redbrook Colliery, owned by the Old Silkstone Collieries, Ltd., a pit which was sunk many years ago, but which has never been opened out. Now, the company is erecting the headgear, and installing in the Parkgate seam the most up-to-date arrangement of underground conveyors and gate end loaders, on the lines of the most recent developments in mechanised mining. The size of the shaft is also being increased. The Parkgate seam is at present being worked extensively at the company's Dodworth colliery, and one of the objects of the present development is the lowering and raising of men at Redbrook, which will obviate the transport of men for 2½ miles from the Dodworth pit. The royalty area at Redbrook is very extensive, and it is anticipated that the present scheme will enable the company to employ a substantially increased number of men. The new shaft passes through the Parkgate seam at a depth of 260 yards to the Whinmoor seam, which is about 500 yards deep, and, at a later date, the development of the seams below the Parkgate will be considered. The company has been investigating the possibilities of the distillation of oil from coal, and it is its intention to follow this scheme up. The managing director of the company expresses the opinion that the coal seams in the Barnsley area will admit of expanding production for the next half-century. The Staveley Coal and Iron Company, Ltd., also has a scheme for development at Warsop, near Mansfield. At present it is working only one seam—the Top Hard—at its Warsop Main colliery, but during the past year plans have been prepared for an entirely new shaft, which will be 800 yards deep and will touch all the ten seams in the district. This colliery, when opened, will find employment for 1000 men, but there is no likelihood of the enterprise being carried out until an improvement in trade warrants it.

Cutlery and Plate.

January was a very quiet month in the cutlery and plate trades, and February has not opened any better. The ordinary home demand is smaller than it was a year ago, and there has been a rather considerable falling off in the trade with the cheap bazaars. Contracts for the supply of table ware to hotels and restaurants provide a fair volume of work, and there are substantial orders on hand for cutlery and plated articles to be distributed for advertising purposes, and in return for coupons. In connection with the inquiry from America—to which I referred last week—for quotations for safety razor blades in quantities of 5, 10 and 25 millions, it is interesting to note that the inquirers—a Chicago firm—specify that the blades must be of first-class quality, made from the best Sheffield steel, and state that they have previously been receiving blades from Germany which have not proved satisfactory.

Doncaster Silk Factory.

The whole of the machinery has now been installed at the artificial silk factory which British Bemberg, Ltd., has erected at Doncaster, and the manufacture of artificial silk is expected to commence before this month is out. There are already 50 clerks and 435 hands at work, and this number will be increased rapidly during the year. The 30 Doncaster girls who are in Germany undergoing a special course of training at the company's works there will return towards the end of the month, and form the nucleus of the staff to be engaged in artificial silk manufacture.

Dismantling a Paper Mill.

The Albert Paper Mills, at Retford, which were closed some time ago owing largely to foreign competition and bad trade, have been purchased by Oxley and Co. (Machinery), Ltd., of Sheffield. The purchase includes the whole of the land and buildings, and the extensive plant and machinery. The machinery is being dismantled and disposed of. Some of the papermaking machines are being sold to foreign concerns.

NORTH OF ENGLAND.

(From our own Correspondent.)

International Coal Agreements?

THE suggestion emanating from Scandinavia that a move is possible in the direction of a European coal agreement between Great Britain, Germany and Poland, has excited some interest among Durham and Northumberland coalowners. They, however, make no secret of the fact that they are not sympathetically disposed towards the proposal. It is easy to talk of international price arrangements, but difficult to carry them out. It is not even a simple matter nationally. This has been proved by recent experiences. The Coal Mines Act was intended to co-ordinate prices in the districts, but we find even now that only a few areas have fixed prices, and that such areas are having to meet the competition of other home districts which have not yet agreed upon their minimum prices. A permanent price arrangement with Poland would mean, of course, a loss to Northumberland of those markets which Poland captured during and after the 1926 stoppage. The allocation of markets would doubtless be on the basis of the best periods of trade. Then, after an arrangement of this kind is made—assuming it to be made—Russia has to be reckoned with, the exports of coal from that country having been on a steadily increasing scale.

Cleveland Iron Trade.

The Cleveland pig iron market has entered upon another quiet spell. Most of the big consumers have covered their requirements for a few weeks ahead, and they are inclined to await developments. Producers, however, are comfortably situated. The whole of the output is going promptly into consumption, and some small inroads have been made into the accumulated stocks. The consumption of iron at the local steel works is on a heavier scale, and if deliveries to Scotland and shipments abroad are limited, Cleveland iron at present prices has shut out foreign iron from this district. The fixed minimum prices to all areas except Scotland are unchanged, the standard No. 3 quality being 58s. 6d., No. 1 foundry 61s., No. 4 foundry 57s. 6d., and No. 4 forge 57s.

Hematite Pig Iron.

Merchants and makers report occasional small sales of East Coast hematite for continental customers, and a steady, though far from extensive, home trade. Terms of contract vary, but 69s. for ordinary qualities may be given as the basis of market values, though some customers claim they can purchase on slightly lower terms.

Iron-making Materials.

Consumers of foreign ore are carrying considerable stocks and are heavily bought. Best Rubio ore is nominal at 16s. c.i.f. Tees. There is an excessive supply of blast-furnace coke, and though sellers quote 17s., as a delivered price, this figure can be shaded.

Manufactured Iron and Steel.

There is a little more activity at the steel works, and quotations of all descriptions keep steady. Orders for rails and constructional steel have come in a little more freely of late, and the plant is working less intermittently. A marked dearth of shipbuilders' specifications, however, is everywhere apparent, and export orders are also scarce.

The Coal Trade.

There is no strength in the Northern coal trade beyond seasonal requirements. Coal stocks all over the Continent and in Scandinavia are plentiful, so that inquiries for any kind of fuel are below the average for the time of the year. There are increasing efforts abroad to induce big consumers to take native coal. According to advices, foreign ports, like those in this country, are full of idle tonnage. Many of the collieries in Northumberland and Durham are running short of trade, and there may be some difficulty in the near future in keeping some of the pits continuously employed. Production is in excess of current requirements, and with the pressure of unsold supplies on the market, values of practically all classes of North-country fuel are exceedingly weak. Except for a few of the most favoured brands of coal, second-hand sellers are prepared to discount the fixed minimum quotations by as much as 3d. per ton. High-class Durham gas coal and certain grades of both Durham and Northumberland steam coal are about the only descriptions showing any steadiness. If the present shortage of business continues much longer, it might become necessary to modify the output quotas operating in this district. There is certainly too much coal about just now, and an adjustment of production to suit the smaller requirements might help to steady values. Best Northumberland steam coals can be obtained direct at 13s. 6d., and at slight discounts through second-hand holders at about 13s. to 13s. 3d. Prime Durham steams are quoted steadily, and producers state that they have abundant trade on hand, and 15s. to 15s. 6d. is firmly indicated. There is a fairly good trade passing for best Durham gas coals, and supplies are short of requirements. Prime qualities hold to about 15s. to 16s., but second qualities can be obtained at discounts on 13s. 6d. Coking and good bunker classes are offered at 13s. 6d. Gas coke for export meets a quiet but steady demand. Best kinds are quoted at 21s., and other qualities at 20s. Patent oven coke stocks are ample and in poor request at easy values of about 16s. 6d. for export. Beehive and superior foundry coke are quiet but steady at 24s. to 28s. 6d.

SCOTLAND.

(From our own Correspondent.)

Dull Markets.

THE general tone of markets is dull, but it would appear, in view of recent inquiries, that there is some hope of the recurrence of seasonal demands from overseas. Meanwhile, bookings in steel, iron and coal fail to show any increase, and the outlook is discouraging. Home markets also are depressed.

Steel.

There is no tendency towards improvement in the steel trade. There does not seem to have been much response to the increase in rebates, and there is a scarcity of orders for almost all classes of material. Specifications for shipbuilding requirements are very scarce, and inquiries on export account are few and far between. The reduction in the price of galvanised sheets has not improved trade to any extent. Business in black sheets is perhaps a shade better than a month or so ago, but makers require orders, especially for the heavier gauges. The turnover in tubes is unsatisfactory and irregular. Small diameter tubes are more or less neglected, but large tubes have some comparatively good orders. Demands for butt-welded tubes are especially scarce, owing to the almost complete cessation of business with South America and Australia. Orders for steel rails have been placed to the amount of about 3000 tons.

Iron.

Ironmakers are suffering to some extent from the scarcity of orders for tube strips, while steel re-rollers are affected by home competition and the weakness in continental prices of small steel bars. Iron prices are unchanged, and re-rolled steel bars continue to show an easier tendency with the home price about £6 17s. 6d. and export £6 10s. per ton.

Pig Iron.

The number of furnaces in blast in Scotland has been increased to ten. This is not due to any increase in business, but in order to replenish stocks at associated works. Shipments of pig iron from Glasgow last week amounted to 607 tons (278 tons foreign), compared with 894 tons (784 tons foreign) in the corresponding week last year.

Scrap.

Transactions in scrap materials are very modified at present, and prices continue to show a weakening tendency, with cast iron machinery at 56s. 6d. and heavy steel 47s. 6d. per ton.

Coal.

There is still a great dearth of orders for export fuel in the Scottish coal market. Any business being done

is for small quantities for prompt shipment, practically nothing of a forward nature being mentioned. Generally speaking, owing to the quota system, supplies of screened fuels are scarce, and prices are maintained on a firm level. Best Fifeshire steams provide an exception, these being none too well booked at the moment. Lanarkshire splints have a steady outlet, but can now be secured somewhat below recent prices. Washed nuts in all districts are fairly plentiful and tend easier. Aggregate shipments amounted to 197,517 tons, against 205,504 tons in the preceding week, and 245,365 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

COAL shipments from this district have not yet reached the figure prevailing before the stoppage of work in the coalfield early last month. The total last week, according to the Great Western Railway Company's statistics, came to 485,800 tons, which compared with 444,700 tons for the preceding week and with 644,635 tons for the corresponding period of last year. It will thus be seen that considerable leeway has to be made up. The figures for this week should, however, show some improvement, as, notwithstanding the quietness in evidence on the market, loading operations have been active. At the end of last week the returns showed that the number of tipping appliances which were idle was only 16 and there were 10 steamers waiting their turn to get a berth. The situation on Monday as the result of week-end arrivals was that an even stronger loading position was disclosed, as there were only eight tips idle at the whole of the docks, while no less than 12 vessels were waiting for a berth, of which 10 were at the Bute Docks, Cardiff. It will thus be seen that the position was extraordinarily good for steam coal collieries, and yet the coal market displays no real life at all. It is difficult, indeed, to reconcile the conditions. They can only be explained by the fact that ten days or so ago chartering operations were on a brisk scale, though they have since slackened off considerably, while, in addition, a substantial amount of business must go through the hands of the big combines and, as a consequence, does not come on the open market at all. Still, even allowing for that, there can be no doubt that business in steam coals has faded away to an appreciable extent during the past week or so. This is not confined to South Wales, but, from all accounts, it is very general and applies not only to this country, but to the continental coalfields. This slackness in the foreign demand applies both to coals for early shipment and for delivery over a period. At the moment, the only order pending is that for the supply of coals for delivery to the Norte Railways of Spain over the next two months, for which prices have to be sent in this week.

Coalfield Agreement.

The new coalfield agreement to apply to this district was signed on Monday last at a special meeting of the Conciliation Board, held at Cardiff, and is, of course, a matter for considerable satisfaction to all concerned. Hopes are, therefore, entertained that this district will be free from strife for a period of three years, as the agreement runs up to January, 1934, and thereafter until the expiration of one month's notice from either side. The new agreement embodies mainly the provisions of the agreement which terminated on November 30th last, with, of course, modifications made necessary by the new Mines Act. Inasmuch as there was no agreement between the parties with regard to the minimum percentage and the subsistence wage, these points will go before the independent chairman, in accordance with the terms of settlement arrived at in London last month. The name of the independent chairman has not yet been disclosed, the reason being that the Lord Chief Justice has not yet finally made the appointment. Unofficially, it is stated that the Lord Chief Justice has suggested the name of a gentleman for the post, but that he is to be approached again with a view to his making another nomination.

LATER.

When the Coal Conciliation Board resumed its meeting on Tuesday, the workmen's representatives argued their case for an increase in the minimum percentage from 28 to 42·2 per cent. and an advance in the subsistence wage from 7s. 10½d. to 8s. 3d. It was provisionally arranged for the Board's next meeting to be held on February 23rd, when it is hoped that the independent chairman, acceptable to both parties, will have been appointed, and will be able to attend and preside over the meeting.

Dry Docks Amalgamation.

At the end of last week the details were announced in connection with the proposed amalgamation of the two largest dry dock and engineering undertakings in this district, viz., the Mountstuart Dry Docks, Ltd., and the Cardiff Channel Dry Docks and Pontoon Company, Ltd. Meetings of shareholders are to be held next week, and it is fully expected that the scheme will meet with the necessary approval. It is pointed out that the share capital of the Channel Company has remained at its original amount, whilst the Mountstuart Company has a considerable amount of unissued share capital which can be issued without incurring capital duty, and that for that reason it is considered advantageous that the Mountstuart Company should be the purchasing company. It looks as if, however, it is the intention for the two companies to retain their separate entities, as there is to be an exchange of directors. Mr. John Cory, who is now the chairman of the Channel Company, becomes as well the chairman of the Mountstuart Company, and Mr. John Elliot becomes the vice-chairman and managing director of both undertakings. The offer for the exchange of Channel shares into the Mountstuart shares is conditional upon shareholders representing nine-tenths in value or less, as the directors may agree, accepting before the 28th inst. The fusion of these two concerns will mean that the new combine will have the control of about 90 per cent. of the private dry-docking accommodation of Cardiff, Barry and Newport, as it will own 10 large dry docks, one large pontoon, two slipways and gridirons capable of accommodating vessels up to 14,000 tons.

Miners and the Dole.

At the end of last week the award of Mr. Ernest W. Wingate-Saul, the umpire under the Unemployment Insurance Act, on the appeal by the Insurance Officer against a decision of the Court of Referees at Maesteg allowing unemployment benefit to workmen idle during the recent stoppage of work in the South Wales coalfield, was issued. This award, which applies to underground workers, was against the workmen, and the decision of the Court of Referees was reversed. The award of the test case in regard to surface workers has not yet been given.

Current Business.

The tone of the steam coal market is very quiet. Most of the leading undertakings are well off for stems for large coals, though, so far as new business is concerned, better prices than the minima are unobtainable. The only section of the market which shows any real firmness is that for sized coals, which meet with a fair inquiry and are rather scarce for early shipment, but in the case of smalls, the demand is wholly unsatisfactory and supplies are freely offered at the minima. The market for patent fuel and coke displays no special feature, but pitwood is steadier at 25s. 6d. to 26s.

LAUNCHES AND TRIAL TRIPS.

OPAWA, twin-screw motor ship; built by Alexander Stephen and Sons, Ltd., to the order of New Zealand Shipping Company, Ltd.; dimensions, 490ft. by 67ft. by 40ft.; to carry cargo in bulk. Oil engines of Stephen-Sulzer type; constructed by the builders; launch, January 20th.

SINGLE-SCREW CARGO STEAMER; built by Harland and Wolff, Ltd., to the order of the British Phosphate Commissioners; dimensions, 365ft. by 54ft. by 34ft. 6in.; to carry phosphate in bulk. Engines, triple-expansion, 25in., 42in. and 70in. by 48in. stroke; constructed by John G. Kincaid and Co., Ltd.; launch, January 22nd.

AGUILA, twin-screw motor ship; built by Henry Robb, Ltd., to the order of the Forestal Land, Timber and Railways Company, Ltd.; dimensions, 260ft. by 42ft. by 12ft. 6in.; to carry 1500 tons. Oil engines of Atlas type; constructed by the Atlas Diesel Company, Stockholm; trial trip, January 23rd.

SOUDAN, single-screw steamer; built by Barclay, Curle and Co., Ltd., to the order of P. & O. Steam Navigation Company, Ltd.; dimensions, 458ft. by 60ft. 6in. by 40ft. 9in.; to carry cargo. Engines, quadruple-expansion, 30½in., 44in., 63½in. and 91in. by 57in. stroke, pressure 230 lb. per square inch; constructed by the builders; trial trip, January 23rd.

J. H. FISHER, pilot cutter; built by Earle's Shipbuilding and Engineering Company, Ltd., to the order of Humber Pilots' Steam Cutter Company, Ltd.; dimensions, 140ft. by 26ft. by 13ft. Engines, triple-expansion, 13½in., 22in., 37in. by 24in. stroke, pressure 180 lb. per square inch; constructed by the builders; trial trip, January 26th.

BRITISH SCIENCE, oil tank motor vessel; built by Palmers Shipbuilding and Iron Company, Ltd., to the order of British Tanker Company, Ltd. Engines, oil, Doxford type; trial trip, January 27th.

ROCKABILL, steel screw steamer; built by David and William Henderson and Co., Ltd., to the order of Clyde Shipping Company, Ltd.; dimensions, 270ft. by 37ft. by 18ft. 9in.; to carry cattle and cargo. Engines, triple-expansion, 21in., 34in. and 56in. by 39in. stroke, pressure 185 lb. per square inch; trial trip, January 29th.

YARD No. 337, motor ship; built by Caledon Shipbuilding and Engineering Company, Ltd., to the order of Aktiebolaget Gotaverken, Goteborg, Sweden; dimensions, 449ft. 10in. by 59ft. by 35ft. 6in. Oil engines, constructed by Aktiebolaget Gotaverken; the engines will be installed when the hull reaches Goteborg; launch, February 3rd.

AIRE; built by Cammell Laird and Co., Ltd., to the order of London, Midland and Scottish Railway Company; trial trip, recently.

PRESTOLONASLEDNIK PETAR, twin-screw steel steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Jadranska Plovidba D.D., of Susak; dimensions, 270ft. by 36ft. 2in.; to carry passengers. Engines, quadruple-expansion; constructed by the builders; launch, February 4th.

AUTOCARRIER, twin-screw steamer; built by David and William Henderson and Co., Ltd., to the order of the Southern Railway Company; dimensions, 230ft. by 35ft. 6in. by 15ft.; to carry motor cars and passengers across Channel. Engines, triple-expansion, 15in., 25in. and 41in. by 24in. stroke, pressure 200 lb. per square inch; constructed by the builders; launch, February 5th.

STRATHNAVER, electrically propelled steamer; built by Vickers-Armstrong, Ltd., to the order of Peninsular and Oriental Steam Navigation Company; dimensions, 664ft. by 80ft. by 46ft. 6in.; to carry passengers. Engines, turbo-alternators, two B.T.H.-Curtis sets, high-pressure water-tube boilers, 400 lb. per square inch; constructed by Yarrow and Co., Ltd.; launch, February 5th.

CATALOGUES.

WEST'S GAS IMPROVEMENT COMPANY, Ltd., Miles Platting, Manchester.—Catalogue dealing with West's lip-bucket conveyor.

STURTEVANT ENGINEERING COMPANY, Ltd., 147, Queen Victoria-street, E.C. 4.—Publication 1371, dealing with air washers, air filters and air conditioning apparatus.

JOHN A. SMEETON, Ltd., 15, Victoria-street, S.W. 1.—Catalogue of foundry plant and equipment manufactured by the Badische Maschinenfabrik, Durlach, Germany.

HOLMAN BROS., Ltd., Camborne, Cornwall.—Latest publications on the "Turngrip" drill sharpener, "S" type stationary air compressor, and the Hele-Shaw-Beacham portable compressor.

HOLLINGS AND GUEST, Ltd., Thimble Mill-lane, Birmingham.—Lists No. A113 of hydraulic forging and flanging presses; No. A115 of rolls for bending, corrugating and straightening angles, plates, &c.

GENERAL ELECTRIC COMPANY, Ltd., Magnet House, Kingsway, W.C. 2.—A brochure on the G.E.C. dock lighting system for the Port of London, and Catalogue W.O. Section, first edition of overhead line fittings

GROUPEMENT PROFESSIONNEL DES FABRICANTS DE CIMENT PORTLAND ARTIFICIEL DE BELGIQUE, 45, Boulevard du Régent, Brussels.—Brochure No. 5—Le Ciment Portland Artificiel, fabrication—propriétés, Mortiers et Betons; Brochure No. 9—Le Manuel du Béton Armé; Brochure No. 11—Exécution de la route de la rue en béton; Brochure No. 12—Les Enduits de Ciment.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MR. A. T. STARR, B.A., B.Sc., has been appointed to the vacancy on the staff of Faraday House Electrical Engineering College.

ALFRED HERBERT, Ltd., of Coventry, has been appointed sole agent in this country for the lathes and special machines manufactured by the R. K. Le Blond Machine Tool Company, of Cincinnati.

INTERNATIONAL COMBUSTION, Ltd., the Underfeed Stoker Company, Ltd., and Combustion Steam Generator, Ltd., ask us to announce that, on March 1st next, they will move from their present offices in Africa House, Kingsway, to Aldwych House, Aldwych, London, W.C. 2.

GUY F. DOWDING, A.M.I. Mech. E., of 38, Albert Embankment, London, S.E. 11, asks us to announce that he has been appointed by Messrs. Farmer, Stedall and Co. to act as general manager for the development of sales of Reinecker machine tools in Great Britain. Arrangements have now been concluded for centralising this department at 38, Albert Embankment, Vauxhall, which in future will be known as Reinecker Sales Office.

THE TRIESTE SHIPYARDS AND ENGINEERING COMPANY, Ltd., of 4, Lloyds-avenue, E.C. 3, asks us to announce that an amalgamation of the various shipyards at Trieste, Monfalcone, Venice and Muggia, which it represents in London, has recently been effected. The Cantiere Navale Triestino, the Stabilimento Tecnico Triestino and the Cantiere San Rocco, have now been united under the style of the Cantiere Riuniti Dell' Adriatico, the headquarters address of which firm is Palazzo Lloyd, Trieste, and its telegraphic address "Cantnavale," Trieste. The London company also represents the Cantiere Navale Scoglio Olivi, of Pola, in the meantime.

GIBBONS BROTHERS, Ltd., of Dibdale Works, Dudley, ask us to announce that they, in conjunction with Wild-Barfield Electric Furnaces, Ltd., Elecfurn Works, North-road, Holloway, London, N. 7, have acquired from Rudge-Whitworth, Ltd., Birmingham, as from the 1st inst., the sole manufacturing and selling rights of the carburising compound "Eternite." The same staff for manufacturing has been retained. In connection with this acquisition, and also that for the manufacture and sale of mechanically-operated furnaces, Hevi Duty electric type—under agreement with the Hevi Duty Electric Company, of Milwaukee—Gibbons Brothers, Ltd., and Wild-Barfield Electric Furnaces, Ltd., are forming a new company under the title of G.W.B. Electric Furnaces, Ltd.

CONTRACTS.

THE VICKERS WORKS at Sheffield of the English Steel Corporation, Ltd., made the chassis assembly, the crank shaft of the Napier engine, the front and rear axles, and the gears of the "Blue Bird" racing car with which Captain Malcolm Campbell recently set up a world's speed record.

THE HOFFMANN MANUFACTURING COMPANY, Ltd., of Chelmsford, supplied the ball and roller bearings which are incorporated in the "Blue Bird."

J. W. BROOKE AND CO., Ltd., of Lowestoft, have received an order for a quantity of 1 kW electric generating sets from their agents for use in the Dutch East Indies. The power unit will consist of one 2 H.P., two-stroke motor with magneto ignition.

JOSEPH SANKEY AND SONS, Ltd., of Wellington, Shropshire ask us to announce that they have obtained the sole manufacturing rights for the Renault type of steel flooring for workshops which was described in our issue of November 21st, 1930.

THE UNITED STEEL COMPANIES, Ltd., of Sheffield, inform us that "Tormanc" steel has been selected as the light, strong alloy steel for the mast for Sir Thomas Lipton's racing yacht "Shamrock V." The new mast will be 160ft. high and will be made from welded plates of "Tormanc" steel, the steel being made by the Samuel Fox and Co., Ltd., branch, and the plates rolled by the Appleby branch. The plates will be welded by the Quasi-Arc process. Two masts are being provided, and they will each absorb 4 tons of the special steel.

THE Great Western Railway announces that it has placed the following orders with outside firms. The first two are in connection with the £1,000,000 Paddington rebuilding scheme—at Bishops-road, where the station is to be remodelled and enlarged to deal with the whole of the local services, and increasing suburban traffic, and at Westbourne Park, where electric power signalling is to be installed:—(*a*) Earthwork, retaining walls and other work at Bishops-road Station, Paddington, Cleveland Bridge and Engineering Company, Ltd., Darlington; (*b*) provision and installation of electric power signalling at Westbourne Bridge, Paddington, General Railway Signal Company, Ltd., London; (*c*) reconstruction and widening of Bath-road Bridge over Windsor Branch, near Slough Station, D. G. Somerville and Co., Ltd, London; (*d*) supply and erection of a refuse destructor at Sudbrook pumping station, Heenan and Froude, Ltd., Worcester; (*e*) supply and erection of two electric 5-ton goods lifts for South Lambeth warehouse, Wm. Wadsworth and Sons, Ltd., Bolton; (*f*) work in connection with the renewal of Board of Trade Passenger Certificate and Lloyd's Special Survey No. 3 of the steam tender "Sir Walter Raleigh," Bickle Engineering Company, Ltd., Plymouth; (*g*) supply and erection of two 1-ton, three 30 cwt. transporter cranes for Paignton, St. Austell and South Lambeth goods sheds, and one 6-ton electric overhead travelling crane for Swindon, Wharton Crane and Hoist Company, Ltd., Reddish; and (*h*) demolition of buildings at Bristol, Wapping Wharf, J. and P. Zammit, Llanelly.

PACKING FOR ABROAD.—We have received from Professor Snape, of the University of Cape Town, a letter in which he complains of the packing of machines received from this country. In one case the packing case was much too light, and as no grease had been rubbed on the machined parts they were covered with rust. No attempt had been made to render the case waterproof. In another instance the packing case was strong enough, but again there were open joints in it and the machine was protected only by a little waterproof paper on the top; there was none round the sides. The necessity of good packing has been frequently pointed out, and it is deplorable that complaints like that from Professor Snape should still occur. Packing cases for long voyages should have close joints and should be reasonably waterproof, whilst every machined part should be thoroughly protected by a thick coating of grease or, better still, by a removable paint.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	16/- to 20/6
(1) Spanish	16/- to 19/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	16/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 15 0	—
No. 1 Foundry	3 16 0	—
No. 3 Foundry	3 13 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 9 0	3 9 0
No. 1	3 9 6	3 9 6
Cleveland—		
No. 1	3 1 0	3 1 0
Siliceous Iron	3 1 0	3 1 0
No. 3 G.M.B.	2 18 6	2 18 6
No. 4 Foundry	2 17 6	2 17 6
No. 4 Forge	2 17 0	2 17 0
Mottled	2 16 6	2 16 6
White	2 16 6	2 16 6
MIDLANDS—		
(c) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 6 0	—
„ „ Foundry	3 11 0	—
(c) Northampton—		
Foundry No. 3	3 7 6	—
Forge „	3 2 6	—
(c) Derbyshire—		
No. 3 Foundry	3 11 0	—
Forge	3 6 0	—
(3) Lincolnshire—		
No. 3 Foundry	—	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 1 6 (a)	—
	4 3 6 (b)	—
	4 8 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 5 0	—
Second Quality Bars	8 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	10 5 0	—
Best Bars	11 0 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	9 15 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	8 15 0 to 9 5 0	—
Gas Tube Strip	10 17 6 to 11 0 0	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 0 0	10 0 0
Ship Plates, ¼in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	8 0 0	8 0 0
Sheets (Gal. Cor. 24 B.G.)	11 7 6	11 0 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 15 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	6 10 0 to 9 0 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	7 2 6	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	9 5 0	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	8 12 6 and 9 2 6	—
Intermediate Basic	7 2 6 and 7 12 6	—
Soft Basic	6 5 0	—
Hoops	10 5 0	—
Soft Wire Rods	7 15 0	—
MIDLANDS—		
Small Rolled Bars	7 7 6 to 8 5 0	—
Billets and Sheet Bars	5 10 0 to 6 0 6	—
Galv. Sheets, f.o.b. L'pool	11 0 0	—
(2) Staffordshire Hoops	9 10 0	—
(d) Angles	8 7 6	—
(d) Joists	8 15 0	—
(d) Tees	9 7 6	—
(d) Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 5 0	—

NON-FERROUS METALS.

SWANSEA—		
Tin-plates, I.C., 20 by 14	f.o.b.	15/3 to 15/6
Block Tin (cash)		116 5 0
„ (three months)		117 15 0
Copper (cash)		45 5 0
„ (three months)		45 0 0
Spanish Lead (cash)		13 10 0
„ „ (three months)		13 12 6
Spelter (cash)		12 5 0
„ (three months)		12 15 0
MANCHESTER—		
Copper, Best Selected Ingots		48 5 0
„ Electrolytic		49 5 0
„ Strong Sheets		75 0 0
„ Tubes (Basis Price), lb.		0 0 11
Brass Tubes (Basis Price), lb.		0 0 9½
„ Condenser, lb.		0 1 0
Lead English		15 7 6
„ Foreign		14 0 0
Spelter		13 2 6
Aluminium (per ton—raw ingot)		£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	2/3 per lb.	
Ferro Tungsten	2/- per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	7/-
„ „ 6 p.c. to 8 p.c.	£22 10 0	7/-
„ „ 8 p.c. to 10 p.c.	£22 0 0	7/-
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£32 10 0	10/-
„ „ „ 1 p.c. carbon	£36 0 0	13/-
„ „ „ 0·70 p.c. carbon	£40 0 0	14/-
„ „ „ carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 0 0 for home	
„ „ „	£11 10 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/- per unit	
„ „ 75 p.c.	£18 10 0 scale 7/- per unit	
„ Vanadium	12/9 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	15/-
„ „ Ell	15/6
„ „ Splint	16/3 to 17/-
„ „ Trebles	13/-
„ „ Doubles	11/9 to 12/-
„ „ Singles	11/-
AYRSHIRE—	
(f.o.b. Ports)—Steam	14/-
„ „ Jewel	17/-
„ „ Trebles	13/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	12/- to 12/6
Screened Navigation	16/6 to 17/6
Trebles	12/- to 13/6
Doubles	12/-
Singles	11/-
LOTHIANS—	
(f.o.b. Leith)—Best Steam	13/6 to 14/-
Secondary Steam	13/6 to 14/-
Trebles	13/-
Doubles	12/6
Singles	11/6

ENGLAND.

(8) N.W. COAST—	
Steams	29/-
Household	30/- to 31/-
Coke	20/- to 20/6
NORTHUMBERLAND—	
Best Steams	13/6
Second Steams	12/6
Steam Smalls	10/- to 10/6
Unscreened	12/6 to 13/-
Household	27/- to 39/-
DURHAM—	
Best Gas	15/-
Second	13/3 to 13/6
Household	25/- to 37/-
Foundry Coke	26/- to 28/-

SHEFFIELD—	Inland.
Best Hand-picked Branch	25/6 to 27/- —
Derbyshire Best Bright House	20/- to 22/6 —
Best House Coal	20/6 to 21/6 —
Screened House Coal	18/- to 19/- —
„ „ Nuts	15/6 to 16/6 —
Yorkshire Hards	14/- to 15/6 —
Derbyshire Hards	14/- to 15/6 —
Rough Slacks	8/6 to 9/- —
Nutty Slacks	6/6 to 7/- —
Smalls	3/- to 5/- —
Blast-furnace Coke (Inland)	12/- on rail at ovens
Furnace and Foundry Coke (Export), f.o.b.	15/- to 16/-

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	20/- to 20/3
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 19/6
Ordinary Dry Large	17/9 to 18/-
Best Black Vein Large	18/3 to 18/6
Western Valley Large	17/9 to 18/-
Best Eastern Valley Large	17/6 to 17/9
Ordinary Eastern Valley Large	17/3 to 17/6
Best Steam Smalls	13/6 to 14/-
Ordinary Smalls	12/- to 13/6
Washed Nuts	18/- to 22/-
No. 3 Rhondda Large	19/9 to 20/3
„ „ Smalls	15/6 to 16/-
No. 2 „ Large	17/- to 17/3
„ „ Through	15/6 to 16/-
„ „ Smalls	14/- to 14/3
Foundry Coke (Export)	22/6 to 36/6
Furnace Coke (Export)	17/6 to 18/-
Patent Fuel	21/6
Pitwood (ex ship)	25/6 to 26/-
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	35/- to 37/6
Seconds	27/- to 31/6
Red Vein	22/6 to 27/6
Machine-made Cobbles	41/6 to 45/-
Nuts	43/- to 46/-
Beans	24/9 to 28/3
Peas	20/3 to 21/6
Breaker Duff	9/6 to 10/6
Rubbly Culm	8/6 to 9/-
Steam Coals :	
Large	20/- to 21/6
Seconds	18/- to 20/-
Smalls	12/- to 13/-
Cargo Through	17/- to 18/-

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate : Joists (minimum), 22/6 ; Ordinary Ship, Bridge, and Tank Plates and Sections, 15/- if home consumers confine purchases from associated British Steel Makers. (*e*) Delivered Black Country Stations.

French Engineering Notes.

(From our own Correspondent in Paris.)

Trade Reaction.

THERE is no longer any illusion about the character of the set-back that has taken place in the iron, steel and engineering trades. The downward curve continues and, so far, little has been done to check it with the national programme of public works which is still being held up by Parliamentary delays. The sales organisations are helpless against falling prices, and bars are declared to be sold on the international market at less than £4 a ton. An example of the severity of competition is provided by tenders for the supply of twelve locomotives of the "Mikado" type to the Chemins de Fer Coloniaux. Poland secured the order at 6·84f. the kilogramme at works and 7·94f. delivered free; makers in Holland followed with 8·36f., and the Belgians with 9·48ft., while the French tenders were 10f. the kilogramme delivered at works. Another example of declining activity is afforded by the returns of iron and steel production during 1930, issued by the Comité des Forges, which show that the output of pig iron was 10,098,000 tons, as compared with 10,453,000 tons in 1929, while that of steel was 9,425,000 tons, as against 9,655,000 tons. The reduction only began during the second half of the year as the result of the increasing imports of iron and steel, but it has since been steadily accentuating.

Railway Deficits.

The situation of the railway companies appeared so precarious some months ago that Government appointed Monsieur Fournier, of the Bank of France, to institute an inquiry and offer suggestions as to what should be done to avert a threatened financial collapse. Since then the contraction of traffic receipts has been growing. The deficit in 1930 is something like 1200 million francs, to which must be added 500 million francs that have to be repaid from the common fund to the Treasury. As a temporary expedient the companies were authorised to issue debentures in order to meet pressing needs, but something must be done to avoid that necessity in the future. At the time the fund was created in 1921 for an accumulation of reserves, which would cover partial deficits and render the companies independent of any State financial guarantee, it was decided that the fund should be maintained by an increase in railway rates, if necessary. That is strongly resisted by railway users, who declare that higher railway rates will defeat the object in view by still further reducing traffic receipts at a time when trade is bad and requires every possible alleviation of charges in order to pass through a very difficult period. They say that the only remedy is for the State to reduce or suppress the taxes on transport amounting to 32¼ per cent. on the cost of passenger tickets and 10 per cent. on freights for goods. In 1929 these taxes brought to the State 2000 million francs. It now appears that there is unlikely to be any relief from these charges, and it is understood that the report which Monsieur Fournier has submitted to the Government recommends an increase of 24 per cent. in the cost of passenger tickets and of 10 per cent. in the freights for goods. There is to be some financial adjustment, notably in bringing the cost of new rolling stock and its maintenance into the working costs. All this is very unsatisfactory to users, who fear that the higher railway rates will accelerate the downward movement of trade. It is also believed that the situation thus created may have the effect of retarding the distribution of orders for rolling stock under the five years' programme. For the moment that does not trouble wagon builders, who have work assured them for some months to come.

Inland Waterways.

The port of Marseilles is directly interested in the carrying out of the Rhone canalisation scheme, which is being held up for the time being by failure to settle upon definite plans. The extension of the Marseilles docks as far as L'Estaque and the construction of the canal through the Rove to the Carente and the Etang de Berre and its continuation to the Rhone at Arles have all been effected with the idea of creating waterway traffic between Marseilles and Central Europe. The scheme has been delayed because it is found that the canalisation of the Rhone, as originally proposed, is impracticable. The only alternative is the construction of a lateral canal, and that is what Marseilles is urging as a satisfactory solution, both technical and financial, while from a commercial point of view it is declared to be indispensable. It is regarded as the only way to counteract the effects of the programme which Germany will have completed within the next five or six years for connecting up the valleys of the Rhine and the Danube, whereby there will be uninterrupted waterway communication between Constanza and Rotterdam. In the interests of Marseilles the Rhone must become a main artery of this great Trans-European waterway. Monsieur Brenier, general director of the Marseilles Chamber of Commerce, recently explained the situation to the Confédération Générale de la Production Française when he said that on the Rhone between Lyons and Arles 1 ton of goods was carried for 1 horse-power, whereas on a lateral canal it would be possible to carry from 5 to 6 tons per horse-power. Not only is the Rhone intended to make Marseilles a great port of transit between the Far East and Central Europe, but it will provide a large amount of electrical energy and will allow of the irrigation and drainage of about 700,000 acres of land.

Submarine Depot Ship.

The submarine depôt ship "Jules Verne," which is the only one of its type so far authorised to be constructed under the existing shipbuilding programme, has been launched complete, with propelling machinery, at Lorient. Work upon it began in June, 1929. Its length is 110 m., width 17·2 m., and displacement 5717 tons. The propelling machinery consists of two Sulzer engines developing together 8000 horse-power. The ship is designed for a speed of 16 knots and will carry four 30 mm. guns and four 37 mm. anti-aircraft guns.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

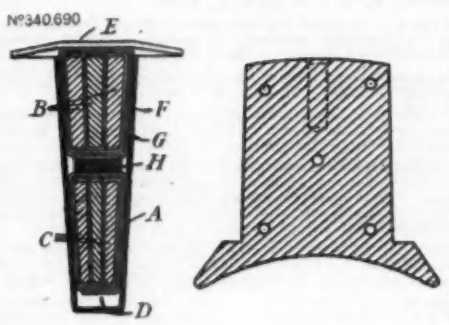
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

340,690. November 5th, 1929.—DYNAMO ELECTRIC MACHINES, Donald Bright Hoseason, of "Grimsworth," Groby-road, Bowdon, Chester, and Associated Electrical Industries, Ltd., of Bush House, Aldwych, Westminster.

The invention relates more particularly, but not exclusively, to D.C. dynamo-electric machines, and has for its object to obtain better heat transference between the conductors and the iron core by providing firm mechanical contact and thus good thermal contact between the insulated conductors and the co-operating parts of the iron core, whereby a good heat flow can take place. The slot section A and the conductors B and C are of wedge shape. Owing to the taper of the slot and conductors the lower conductors C are deeper radially than the upper conductors B, in order that the current density shall be the same in spite of the lower conductors C being narrower. The slot A is made slightly deeper than the total radial depth of



the upper and lower coils. The dimensions of the coil and the slot are essentially such as to leave at the inner end a small space D, whereby the coils may be forced into the slot by the banding wire E, without the coil bedding on to the bottom of the slot, so that the relative movement between the coil and the slot is limited only by the wedging action, and a good thermal contact between the coils and the slot face is obtained. The following insulation is used by way of example, namely, the insulation wrap F, slot lining G, and coil spacer H. The main field pole core is of ordinary construction with the exception that the core is tapered slightly from the pole piece towards the yoke. In a pole having a radial depth of 4in., the yoke end of the pole may be 0·2in. less in width than at the pole piece end thereof. The taper, however, is not critical. The coil will be correspondingly tapered and springs may be interposed between the coil and the yoke to force the coil down the tapered pole to obtain a good thermal contact.—*January 3rd*, 1931.

SWITCHGEAR.

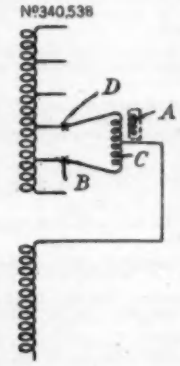
340,867. March 4th, 1930.—ELECTRIC SWITCHGEAR INSTALLATIONS, Felten and Guilleaume Carlswerk Aktien-Gesellschaft, of Köln-Mülheim, Germany.

In enclosed switchgear installations in which the bus-bars are accommodated in a casing filled up with a compound and separated from one another by the latter, a free space must be left in the casing above the compound, owing to the expansion which takes place when the bus-bars become heated. In the free space, which, owing to the high di-electric constant of the compound, is subjected to large electric stresses, ionisation phenomena take place which may lead to disturbances. According to the invention, the free space, which is provided in order to take into account the expansion of the compound, is kept free of electric stresses by a perforated metal sheet connected with the casing and lying on the compound or being embedded in the compound. The metal sheet may be conductively connected with the casing, by means of angle irons. The metal sheet screens the expansion space of the compound electrically, and the openings therein make it possible for the compound to pass over into the electrically screened hollow space. According to another feature of the invention, the openings in the perforated metal sheet are as small as possible as compared with the distance of the metal sheet from the bus-bars or from the nearest parts, which are electrified, in order to avoid point discharges and to keep the distortion of the electric field within moderate limits.—*January 6th*, 1931.

TRANSFORMERS AND CONVERTERS.

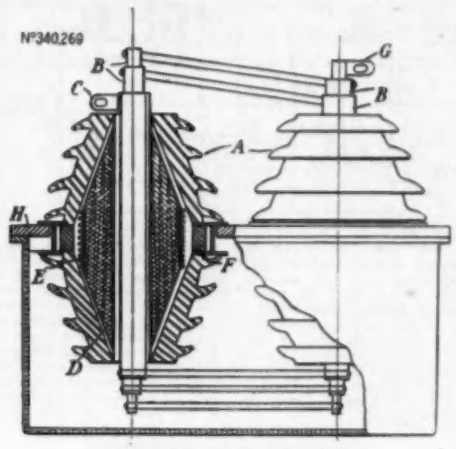
340,538. October 1st, 1929.—VOLTAGE REGULATION OF ELECTRIC TRANSFORMERS BY CHANGING TAPPINGS UNDER LOAD, Ferranti, Ltd., of Hollinwood, and Eric Douglas Tobias Norris, of the same address.

In accordance with this invention, a third short-circuited winding A is associated with the usual choke coil used for tap changing under load. When the switch at B is just about to open, the short-circuited winding A is moved so as to be in close electro-magnetic association with the upper half of the choke coil C connected to the tapping D. This half of the winding will then have a low impedance compared with the other half, and since the current in the two parts of the choke coil will be practically inversely proportional to their respective impedances, the bulk of the current will be carried by this half, and the current in the half connected to switch tapping B will be very small. This small current will be broken when the switch D is opened. If the tapping change were in the other direction so that switch D were about to be opened, then the short-circuited winding would be moved so as to be in close electro-magnetic association with the lower half of the choke coil connected to tapping B. In this way the current to be broken by either switch B or D is reduced to a small fraction of the original value.—*January 1st*, 1931.



340,269. June 24th, 1929.—ELECTRIC TRANSFORMERS, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.; Frederic Horton Clough, of Kilsby, near Rugby; Charles Gilbert Mayo, of 17, Alexandra-road, Rugby, and John Gale Wellings, of "Ricky," London-road, Dunchurch, Rugby.

In accordance with this invention, a combined high-voltage potential and current transformer is constructed in the form of a pair of side-by-side bushing insulators, supported upon the cover or side of an oil-filled tank. The bushing insulators A are of conventional construction, each provided with a core of magnetic material. The core is composed of conductors B of magnetic material connected in series with one another to pro-

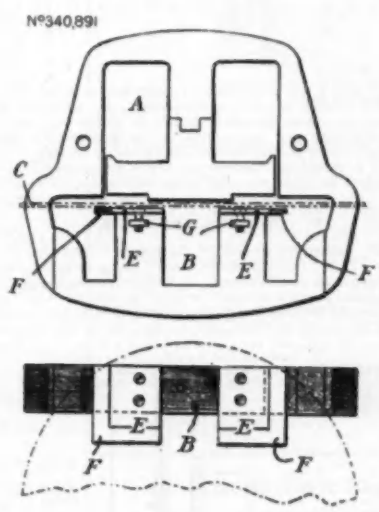


vide a continuous electric circuit. Terminal limbs are shown at C. In one or both of the bushings there is a primary potential winding D, a secondary potential current winding E and a secondary current winding F. The primary potential winding D is connected at its inner end to the conductor C, which serves to distribute the surge voltage over the interior surface of the primary potential winding. The current flowing through the conductors B from the terminal C to the terminal G energises the secondary current transformer winding F, and the conductors B also serve to conduct the flux due to the primary potential winding, although they do not form a completely closed magnetic circuit. The bushings are shown mounted on the cover H of an oil tank, and it will be evident that the arrangement is eminently suitable for use on extra high-potential lines.—*December 24th*, 1930.

MEASURING AND TESTING INSTRUMENTS.

340,891. March 27th, 1930.—MAGNET CORES OF ELECTRIC MEASURING INSTRUMENTS OF THE INDUCTION TYPE, Landis and Gyr S.A., of Hofstrasse 1, Zug, Switzerland.

This invention relates to a temperature compensating device, which permits the temperature error with a power factor of 1 and 0·5 to be eliminated. The driving magnet core is formed of a three-pronged voltage core A and a two-pronged current magnet core B. C is the driving disc of the measuring instrument. On the poles of the current magnet core B there are pieces of sheet metal E F, which extend over the surface of the current pole and increase the acting surfaces of the poles. The pieces of sheet metal E F are fixed to the poles of the current magnet core B by means of screws. Plates G are fitted into slots in the current magnet core B. The parts E are made of iron, and the parts F, which also enlarge the active surfaces of the poles



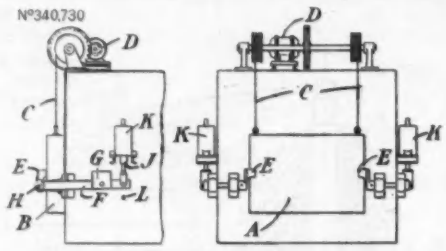
in the same directions, are made of a thermally sensitive alloy, the permeability of which decreases as the temperature rises. This thermally sensitive alloy may advantageously consist of nickel and copper. As the temperature rises the parts F become more and more non-magnetic, so that to a certain extent a reduction in size of the sheet iron polar extensions occurs. Consequently, any increase of the turning moment and reduction of the phase angle between the voltage driving flux and the current driving flux is prevented. By suitable dimensioning of the breadth of the alloy parts F, and by selection of a definite chemical composition of the alloy, it is possible with these sheet metal extensions to compensate for the temperature error of a measuring instrument within a larger range of say, between $\cos\varphi = 1$ and $\cos\varphi = 0{\cdot}5$.—*January 8th*, 1931.

FURNACES.

340,730. December 3rd, 1929.—DOORS OF ELECTRIC FURNACES, Hirsch, Kupfer-Und Messingwerke, Aktiengesellschaft, of Messingwerk, near Eberswalde, Germany.

The invention relates to a door closing device for annealing or similar furnaces, by which the closed door is automatically pressed firmly against the furnace wall. The opening A for charging the furnace is closed by a door B, which is raised and

lowered by wires C by means of the electric motor D. Double-armed levers are provided on the furnace, the short arm E of the levers lying against the door, while the long arm F is provided with a weight G. The levers rotate about a spindle H mounted on the furnace wall. The end of each long lever arm F is connected with the armature J of electro-magnets K, which are secured to the furnace wall. The energising winding of each electro-magnet is connected through the switch of the motor to the supply leads. As soon as the driving motor is connected up and raises the door, the electro-magnets K are also energised and attract their armatures. Each lever arm F is raised and

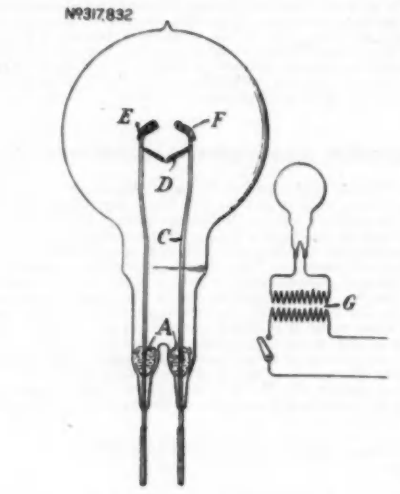


the lever arm E releases the door, so that the latter can be easily moved. After the door has been raised sufficiently and the motor has been cut out, the electro-magnets K release their armatures, so that the arms F lie against pins L, which limit their downward movement. If the motor is again connected up for the purpose of closing the door, the electro-magnets K again attract their armatures and hold the two-armed levers in the raised position until the door arrives in front of the charging opening when the motor is cut off and the armatures J again fall. The levers E are pressed under the action of the weight G against the door and jam it firmly against the furnace wall.—*January 8th*, 1931.

LIGHTING AND HEATING.

317,832. August 23rd, 1929.—METAL ELECTRODE ARC LAMPS, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2.*

The bulb of the lamp described in this specification carries a quantity of mercury A, and also contains inert gas, such as argon, the pressure being preferably about 20 mm. Across the



leads C, which are preferably of tungsten, a metal filament D of coiled tungsten wire, is connected. At the end of leads there are electrodes E and F, which are shown as coils of tungsten. The lamp may be connected in circuit across the secondary of a transformer G, the pressure being about 25 volts. The filament D is raised to incandescence, and subsequently an arc is established between the electrodes.—*December 23rd*, 1930.

MISCELLANEOUS.

340,422. January 23rd, 1930.—RADIATOR TUBES, J. E. Gortner, c.o. J. W. Gortner Supply and Manufacturing Company, Shamokin, Northumberland, Pennsylvania, U.S.A.

No special merit is claimed for this "invention," but it appears to have some interest for those connected with the manufacture of radiators and suchlike appliances. From the drawings, as

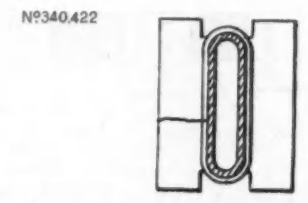


Fig. 1

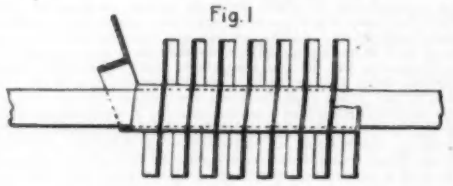


Fig. 2

shown in Fig. 1, it would appear that the inventors intend to use a tube of oval cross section, although that is not specified. Round this tube there is wrapped a strip of angle-shaped metal, preferably of copper, which is nicked both transversely and slightly longitudinally, so that as it is wrapped round the tube the flange parts and wings stand out proudly, as shown in Fig. 1. The process of winding on the strip is indicated in Fig. 2.—*January 23rd*, 1931.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.

TO-DAY.

BRITISH ELECTRICAL AND ALLIED INDUSTRIES RESEARCH ASSOCIATION.—Savoy Hotel, Embankment Entrance, W.C. 2. Annual general meeting. 12 noon.

FARADAY HOUSE OLD STUDENTS' ASSOCIATION.—Hotel Russell, Russell-square, London, W.C. 1. Supper dance. 8 p.m. to 2 a.m.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—In the Non-Ferrous Section of the Applied Science Department of the University, St. George's-square, Sheffield. "The Applications of High-nickel, Nickel-copper Alloys and Pure Nickel in Industry," illustrated by a cinematograph film, by Mr. N. C. Marples. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: NORTH-EASTERN STUDENTS' SECTION.—Armstrong College, Newcastle-on-Tyne. "Vision and Opportunity," by Mr. B. H. Leeson. 7.15 p.m.

INSTITUTION OF LOCOMOTIVE ENGINEERS (LONDON): MANCHESTER CENTRE.—In the Building of the Manchester Literary and Philosophical Society, 36, George-street, Manchester. "The Development of the Piston Valve to Improve Steam Distribution," by Mr. D. W. Sanford. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—At 39, Victoria-street, S.W. 1. Ordinary meeting. Honorary member's lecture, "Monolith Foundations," by Mr. H. Cartwright Reid. 7.30 p.m.

KEIGHLEY ASSOCIATION OF ENGINEERS.—Queen's Hotel, Keighley. "Flight," by Mr. G. B. Fenton. 7.30 p.m.

MANCHESTER ASSOCIATION OF ENGINEERS.—Engineers' Club, Albert-square, Manchester. "The Applications of Electro-deposited Metals to Engineering," by Mr. C. H. Faris. 7.15 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Lecture Theatre, Mining Institute, Newcastle-on-Tyne. "Ship Wave Resistance: An Examination and Comparison of the Speeds of Maximum and Minimum Resistance in Practice and in Theory," by Mr. W. C. S. Wigley. 6 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—Albemarle-street, Piccadilly, W. 1. Discourse, "Ultrasonics: Some Properties of Inaudible Sound," by Professor F. Lloyd Hopwood. 9 p.m.

SOCIETY OF CHEMICAL INDUSTRY: CHEMICAL ENGINEERING GROUP.—Lecture Theatre, the Institution of Civil Engineers, Great George-street, Westminster, S.W. 1. "Silver and its Application to Chemical Plant," by Mr. Donald MacDonald. 6.30 p.m.

SATURDAY, FEBRUARY 14TH.

HULL ASSOCIATION OF ENGINEERS.—In the Municipal Technical College, Hull. "Electric Welding, &c., Applied to Maintenance Work on Railways and Bridges," by Lt.-Col. F. L. Pawley. 7.15 p.m.

STAFFORDSHIRE IRON AND STEEL INSTITUTE.—At the Dudley Arms Hotel, Dudley. Annual dinner. 6.30 p.m.

MONDAY, FEBRUARY 16TH.

BRADFORD ENGINEERING SOCIETY.—Technical College, Bradford. "Modern Boiler Plants," by Mr. H. E. Pearsall. 7.30 p.m.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—In the Non-ferrous Section of the Applied Science Department of the University, St. George's-square, Sheffield. Conjoint meeting for discussion on "Refractories for Heating and Melting Furnaces." 7.30 p.m.

MONDAY TO FRIDAY, FEBRUARY 16TH TO 27TH.

BRITISH INDUSTRIES FAIR, 1931.—Castle Bromwich, Birmingham; Olympia and White City, London. Open 9.30 a.m. daily.

TUESDAY, FEBRUARY 17TH.

IMPERIAL INSTITUTE.—South Kensington, S.W. 7. Exhibition of the Mineral Resources of the Empire.

INSTITUTION OF ELECTRICAL ENGINEERS: SOUTH MIDLAND STUDENTS' SECTION.—The University, Edmund-street, Birmingham. "Short papers" evening. "Comparison of Power Factors of Insulation at High Frequencies," by Mr. J. R. Anderson; "Electric Lighting, Past and Present," by Mr. S. C. Dinenage; "Some Notes on the Mechanical Details of Small Electrical Machines," by Mr. H. E. Lardge; "Transformer 'On-load' Tap Changing Equipment," by Mr. J. R. Smith. Further discussion on Mr. Saunder's paper on "Economics and Engineering." 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Official visit to the British Industries Fair, Birmingham.

WEDNESDAY, FEBRUARY 18TH.

ILLUMINATING ENGINEERING SOCIETY.—At the Home Office Industrial Museum, Horseferry-road, Westminster, S.W. 1. A discussion on "Problems in Illuminating Engineering" will be opened by a series of short contributions on different subjects, including "The Relation between Intensity of Illumination and Visual Capacity," Mr. W. J. Jones; "The Lighting of the Kingsway Tunnel," Mr. J. H. Parker; "Lighting at the International Exhibition of Persian Art," Mr. Oliver P. Bernard; "Lighting for Furniture Spraying," Mr. H. H. Long; "A Problem in Cathedral Lighting," Mr. H. R. L. Goring; "A Problem in Flood Lighting," Mr. R. A. Ives, &c. 6.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Metropole Hotel, Leeds. "Rustless Steels as Applied to Automobiles and Aircraft," by Dr. W. H. Hatfield. 7.15 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Engineers' Club, Albert-square, Manchester. "Light Alloy Piston Development," by Mr. E. V. Pannell. 7 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Bolbec Hall, Newcastle-upon-Tyne. Graduate Section. "The Utilisation of Waste Heat in Oil Engine Installations," by Mr. D. Tagg. 7.15 p.m.

OVERHEAD LINES ASSOCIATION.—At the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, London, W.C. 2. Discussion on "Wayleaves." 5.30 p.m.

ROYAL METEOROLOGICAL SOCIETY.—49, Cromwell-road, South Kensington, S.W. 7. Meeting at 5 p.m.

ROYAL MICROSCOPICAL SOCIETY.—Hastings Hall, B.M.A. House, Tavistock-square, London, W.C. 1. Meeting at 5.30 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. "The Art of the Bridge Builder," by Mr. Gavin Heynes Jack. 8 p.m.

THURSDAY, FEBRUARY 19TH.

DIESEL ENGINE USERS ASSOCIATION.—307, Abbey House, Westminster, S.W. 1. "The Development of the Multi-cylinder Horizontal Oil Engine," by Eng.-Comdr. A. C. Yeates, R.N. 4 p.m.

JUNIOR INSTITUTION OF ENGINEERS: NORTH-EASTERN SECTION.—Visit to Ouston "E" Colliery. 7.15 p.m.

FRIDAY, FEBRUARY 20TH.

INSTITUTE OF METALS.—Official visit to the British Industries Fair at Birmingham. Full particulars may be obtained from Dr. G. Shaw Scott, 36, Victoria-street, London, S.W. 1.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London. Annual general meeting. The annual report of the Council will be presented. Annual election of Council. "An Investigation of Steels for Aircraft Engine Valve Springs," by Mr. Andrew Swan, Mr. H. Sutton, and Mr. W. D. Douglas; and "The Fatigue Strength of Carbon and Alloy Steel Plates as Used for Laminated Springs," by Mr. R. G. C. Batson and Mr. J. Bradley. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—At Royal United Services Institution, Whitehall. Special meeting. "Notes on the Construction of the Variable Density Tunnel for the National Physical Laboratory at Teddington," by Mr. A. J. Grant. 7.30 p.m.

MANCHESTER ASSOCIATION OF ENGINEERS.—Midland Hotel, Manchester. Annual dinner. 6.45 for 7.15 p.m.

SATURDAY, FEBRUARY 21ST.

FINSBURY TECHNICAL COLLEGE OLD STUDENTS' ASSOCIATION.—At the Trocadero Restaurant. Annual dinner. Tickets from Mr. F. R. C. Rouse, 15, Clifton-gardens, Golders Green, London, N.W. 11.

MONDAY, FEBRUARY 23RD.

INSTITUTION OF MECHANICAL ENGINEERS: GRADUATES' SECTION.—Storey's-gate, St. James's Park, London, S.W. 1. "Fatigue in Metals," by Mr. D. G. Sopwith. 6.45 p.m.

TUESDAY, FEBRUARY 24TH.

CHADWICK PUBLIC LECTURE.—The Royal Sanitary Institute, 90, Buckingham Palace-road, S.W. 1. "Silicosis Prevention Methods," by Mr. E. A. Elsby. 8 p.m.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.—39, Elmbank-crescent, Glasgow, C. 2. "Supercharging, with Special Reference to Werkspoor Engines," by Mr. G. J. Lugt. 7.30 p.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: NORTH-WESTERN DISTRICT.—In the Geological Lecture Theatre, Geological Department, at the Victoria University, Oxford-road, Manchester. "The Properties, Selection and Specification of Sandstones for Use as Kerbstones on Main Thoroughfares," by Mr. Edgar Morton. 6.30 p.m.

THURSDAY, FEBRUARY 26TH.

INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—In the Chamber of Commerce, New-street, Birmingham. "Press Tools for Sheet Metal Working," by Mr. J. L. Williams. 7 p.m.

INSTITUTION OF LOCOMOTIVE ENGINEERS.—At the Institution of Mechanical Engineers, Storey's-gate, St. James's Park, London, S.W. 1. "Compound Locomotives on the Paris-Lyons-Mediterranean Railway," by Mr. René G. E. Vallantin, Engineer-in-Chief of Material and Traction of the Paris-Lyons-Mediterranean Railway. 6 p.m.

FRIDAY, FEBRUARY 27TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Visit of the West Midland District to the British Industries Fair, Castle Bromwich, Birmingham. 12.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. "Oil Engines for the Maritime Fishing Industry," by Mr. W. A. Tookey. 7.30 p.m.

FRIDAY, MARCH 6TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. Informal meeting. Lantern lecture, "The Netherlands East India State Railways and Electrification," by Mr. A. M. Hug. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—Science Museum, South Kensington, S.W. 7. Lecture on "The Historic Locomotives at the Museum." Inspection of exhibits. 7.30 p.m.

WEDNESDAY AND THURSDAY, MARCH 11TH AND 12TH.

INSTITUTE OF METALS.—In the Hall of the Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. 1. Annual general meeting.

WEDNESDAY, MARCH 25TH.

ASSOCIATION OF SPECIAL LIBRARIES AND INFORMATION BUREAUX.—At the Institution of Mechanical Engineers, Storey's gate, London, S.W. 1. "George Stephenson's Institute and its Library." 7 p.m.

MONDAY, APRIL 13TH.

INSTITUTE OF TRANSPORT.—At the Institution of Electrical Engineers, Victoria Embankment, W.C. 2. Debate upon the Final Report of the Royal Commission on Transport. 5.30 p.m.

FRIDAY AND SATURDAY, APRIL 17TH AND 18TH.

FARADAY SOCIETY.—The Department of Chemistry, The University, Liverpool. General discussion on "Photochemical Processes." I.: "Molecular Spectra in Relation to Photochemical Change," Friday, 10 a.m., introductory paper by Professor R. Mecke; II.: "Photochemical Kinetics in Gaseous Systems," Friday, 2.30 p.m., introductory paper by Professor M. Bodenstein; III.: "Photochemical Change in Liquid and Solid Solutions," Saturday, 10 a.m., introductory paper by Professor Berthoud; IV.: "Photosynthesis," Saturday, 2.30 p.m., introductory paper by Professor E. C. C. Baly.

CALENDARS, DIARIES, &c.

BURTON, GRIFFITHS AND CO., Ltd., Montgomery-street, Sparkbrook, Birmingham.—Wall calendar with monthly tear-off sheets.

LEO. C. STEINLE, Ltd., 81, Marsham-street, Westminster, S.W. 1.—Wall calendar with monthly tear-off sheets.

TRIESTE SHIPYARD AND ENGINEERING COMPANY, Ltd., 4, Lloyd's-avenue, London, E.C. 3.—Wall calendar with monthly sheets on behalf of Cantieri Riuniti dell' Adriatico.

ENGINEERING AND ALLIED EMPLOYERS' LONDON AND DISTRICT ASSOCIATION.—A dinner was held recently at the Savoy Hotel, when members of the executive committee of the Engineering and Allied Employers' London and District Association entertained its President, Mr. A. Vines. Dr. Campbell, the President of the Association, in proposing the principal toast, referred to the long connection of Mr. Vines with the Association, as representative of Evershed and Vignoles, Ltd., and his work on the executive, sub and sectional committees. Mr. Vines has also been a member of the General Council of the Federation for some years, and for the last three years a member of the Management Board. Mr. Vines, replying, expressed his appreciation of the help given to him by the members of the executive committee and the staff of the Assoc ation.